



Volvo Powertrain



**VOLVO**

*50 Years*

Developing and Manufacturing Powertrains  
Hagerstown, MD

*1961-2011*

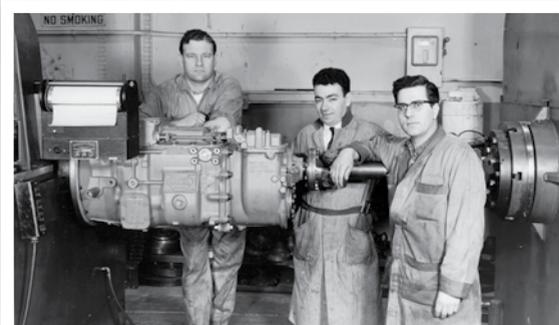
**HAGERSTOWN**  
**VOLVO POWERTRAIN**





Before the arrival of computer-aided systems, Hagerstown engineers and draftsmen devoted many hours making their calculations on slide rules and drafting production drawings by hand.

On February 24, 1961, Mrs. Jeanette Dansberger became the first employee hired for the new Hagerstown location. Fifty years later, she continues to greet our visitors with a smile.



Technicians in the gear lab test cell led numerous Powertrain innovations in the design of truck transmissions.

Engines were positioned in turnover stands in overhaul area for quality verification.



## THE 2011 VOLVO TEAM

Our employees today continue to build on the reputation for skills, knowledge, and professionalism that attracted Powertrain to Hagerstown 50 years ago. Clockwise from upper left: Operations, Product Development (Picture 1 of 2), Purchasing, Quality & Customer Satisfaction, Tour Ambassadors (Retirees), Business Office, Product Development (Picture 2 of 2).

# WELCOME TO HAGERSTOWN

In 1959, Mack Trucks, Inc. saw the need to modernize its antiquated engine, transmission, carrier facility located in Plainfield, New Jersey. Hagerstown, Maryland was selected as the site for the new production facilities. Mack's plans for Hagerstown called for a \$45 million investment in a one million square foot factory on 280 acres.

The site offered Mack easier, faster access to global markets - minutes from major interstates in Western Maryland, close to the Port of Baltimore, convenient to Washington, DC and the highly skilled workforce already available in the region.

The choice was well founded. Today, this facility is the Volvo Powertrain "Center of Excellence" in North America.



## HAGERSTOWN POWERTRAIN TIMELINE

1961 to 2011

# DRIVEN BY INNOVATION



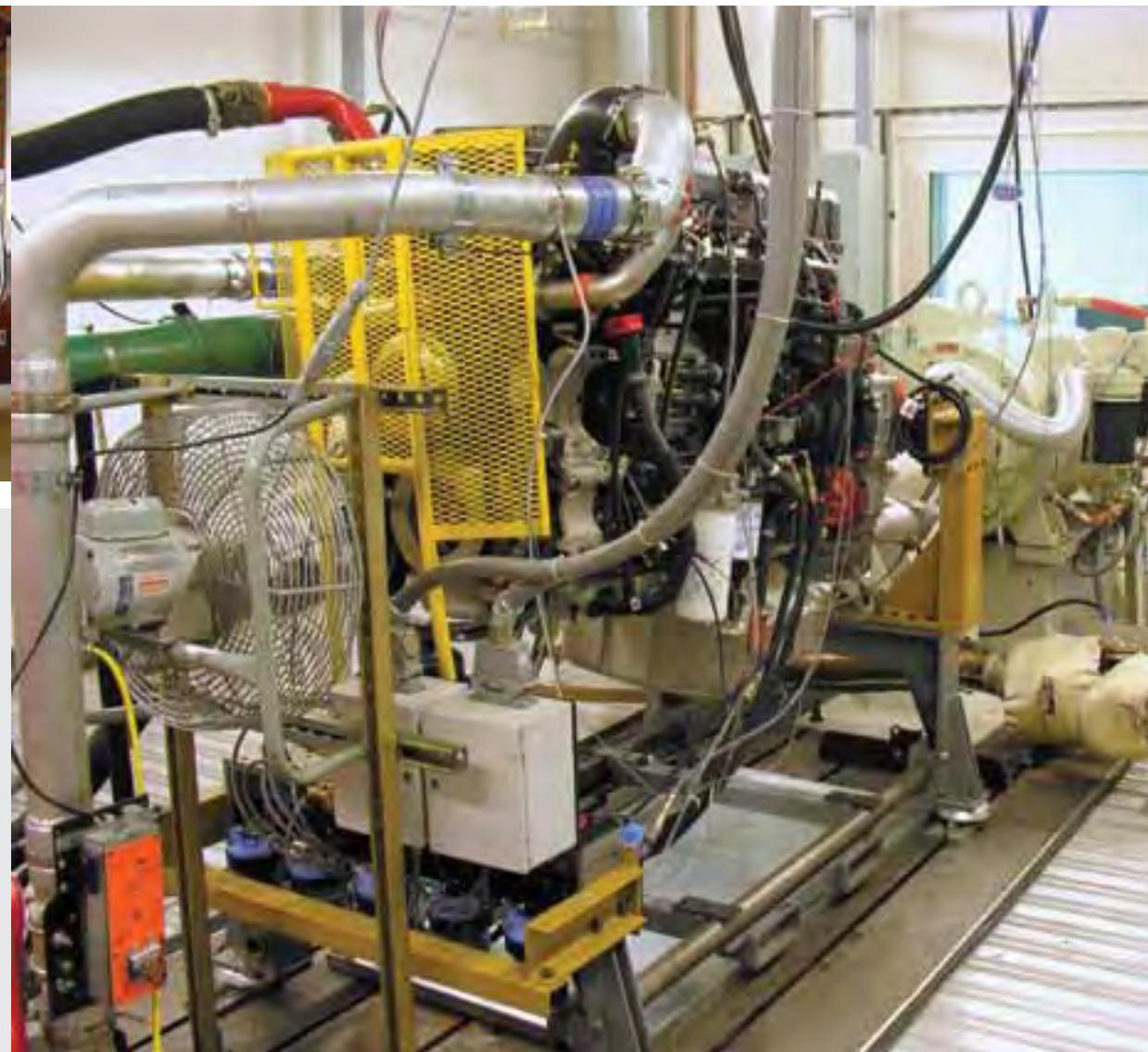
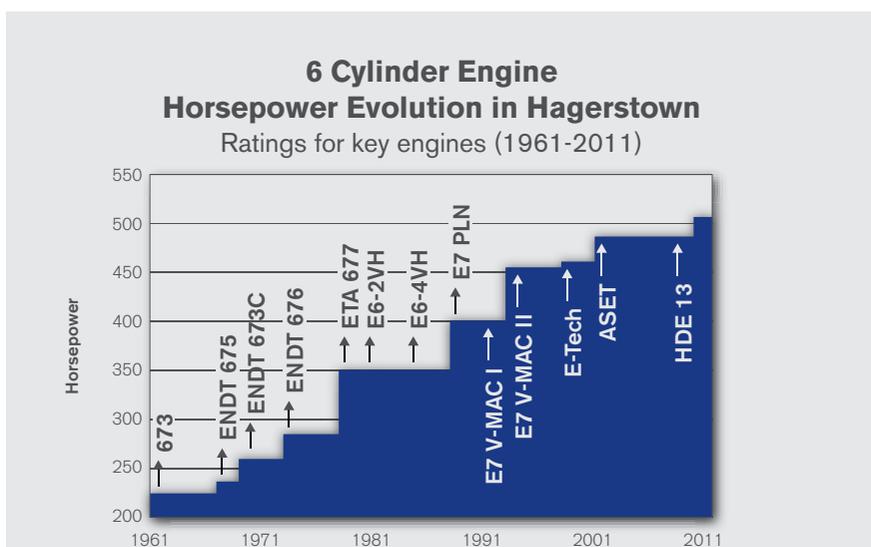
**Clockwise from top right:**

- Engine Development Lab (EDL)
- EDL test cell
- 6 Cylinder Engine HP Evolution in Hagerstown
- The Hagerstown engineers who patented the design concept for the CCRS fuel injection system
- Technician monitors engine performance in the EDL

They say "Necessity is the mother of invention." Many needs have powered the evolution of the engines and geared products developed by Powertrain. The inventive engineers at Hagerstown have registered more than 80 patents in the course of meeting customer needs in a host of powertrain applications. Recognizing that our future is tightly bound to the satisfaction of customers, Hagerstown has always led the development of purpose-built products to take on the toughest work. From the daily grind of refuse collection to long-haul highway routes; from fighting fires to fighting enemies abroad, our customers depend on Hagerstown for the power to get the job done.

## Going for Gold

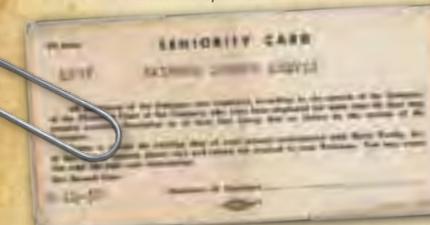
Years ago, Hagerstown products represented the "gold standard" in truck powertrains – literally. Only customers who adopted the all-Mack integrated Maxidyne® and Maxitorque® powertrain in their trucks could display the Gold Bulldog hood ornament. Today, we offer the same quality standard for Mack, Volvo, and Prevost owners everywhere.



## HAGERSTOWN POWERTRAIN TIMELINE

### 1960s

**1961** Mack Trucks Powertrain relocates from Plainfield, NJ.



**1961** November 24: The first Mack® engines roll off Hagerstown's assembly lines.

**1962** UAW organizes the Hagerstown labor work force with Locals 171 Shop Bargaining and 1247 Office Bargaining.



**1962** Hagerstown produces its first V8, the END864 255 HP diesel engine.

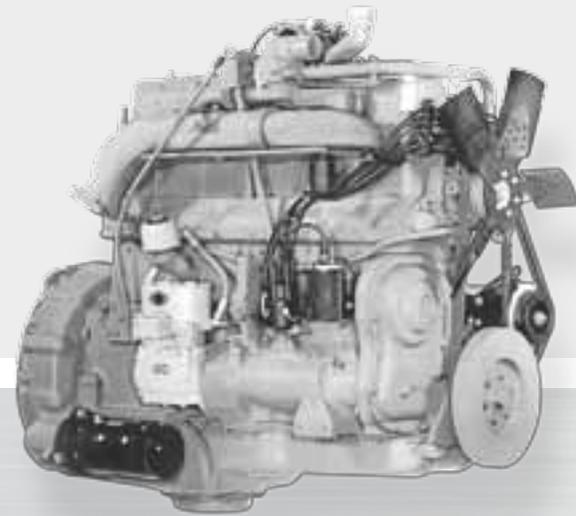
**1962 -** Hagerstown produces Mack's CRD series rear axle carriers; 1,017,522 built up to 1987.



**1962** Hagerstown employees establish the plant's all-volunteer Fire Brigade.

**1962** Hagerstown produces Mack's 110,000 lb. capacity "Planidrive" planetary hub reduction rear drive axles.





6 cylinder gasoline engine

"THE T6 MACK ENGINE OIL TEST WAS THE FIRST MULTI-CYLINDER TEST TO EVALUATE ENGINE OILS. IT SET THE STANDARD IN THE INDUSTRY AND IT WAS DEVELOPED HERE IN HAGERSTOWN."  
 GLENN SHETTER  
 3/3/1969 - 7/1/2002

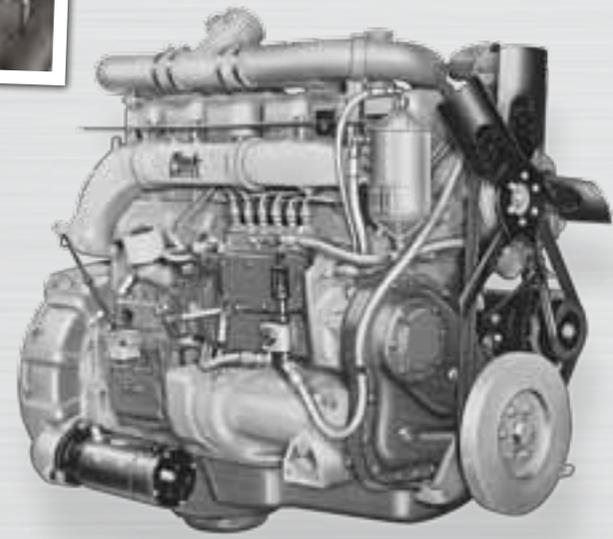


### Keeping The Legend Alive

As Powertrain's newly opened assembly line in Hagerstown began rolling out its first engines for the world's toughest trucks, its engineering team took up the task of ensuring that future generations of our product line would live up to the high expectations of our customers.

The model line-up in 1961 was wide and varied, including gasoline as well as diesel engines, rated from 122 HP up to 276 HP. The following year, Hagerstown engineers unveiled a dramatic new addition: Hagerstown's first-ever V8 END864 engine. The first new product from our new design team quickly earned its place in customer fleets, acclaimed for its combination of power and smooth operation.

In the 1960s, turbochargers became popular because of the demand for increased power for truck engines, and Powertrain began to reach new heights of power output. By 1976, Mack was offering the ET1005 V8 engine. At 360 HP and 998 cu. in., it remains the largest displacement engine built here to date.



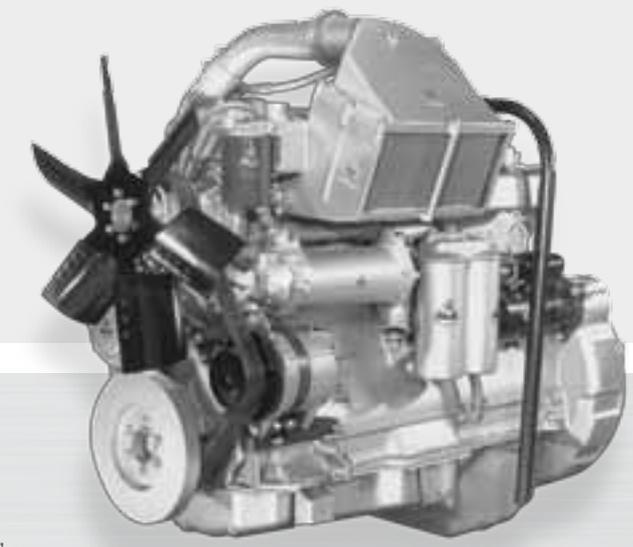
6 cylinder naturally aspirated engine

### Revolutionary

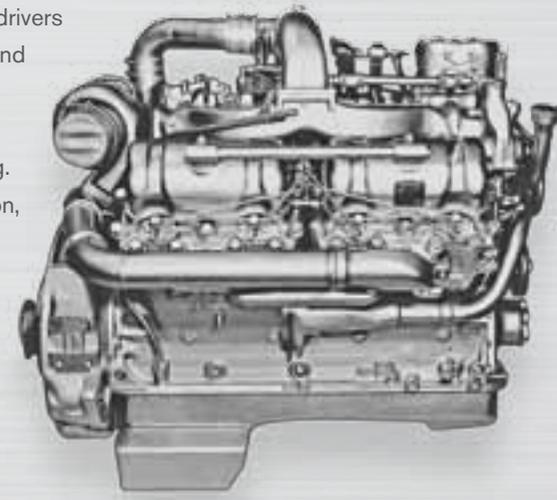
Within just a few more years, Powertrain would establish yet another milestone in truck power. 1967 brought the launch of the ENDT675 Maxidyne engine at 672 cu. in., designed and patented in Hagerstown to deliver maximum horsepower over a wider range of engine speeds than any other standard diesel engine of its day.

From the earliest days of trucking, owners and drivers around the world had been shift, horsepower, and RPM conscious. The revolutionary Maxidyne constant HP engine leveled the power curve, which significantly reduced the need for shifting. Combined with the new Maxitorque transmission, it produced more power at lower RPMs, resulting in substantial fuel savings. A leading trucking magazine wrote, "Maxidyne... the most important engineering advancement in diesel truck operation since the invention of the diesel engine itself."

With power to spare, easier operation and a lower cost to operate, Maxidyne enjoyed tremendous popularity in the trucking world.



E6 Engine



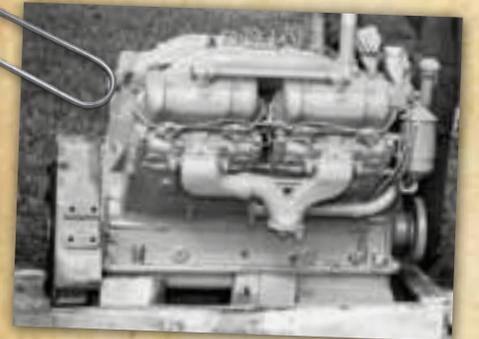
V8 Engine

### HAGERSTOWN POWERTRAIN TIMELINE



1963 - Mack introduces gear-type flywheel Power Take-Off (PTO).

- 1964 Mack introduces the unique "Durapoid" spiral bevel axle gear.
- 1965 Hagerstown produces the ENDT864 300 HP turbocharged V8.

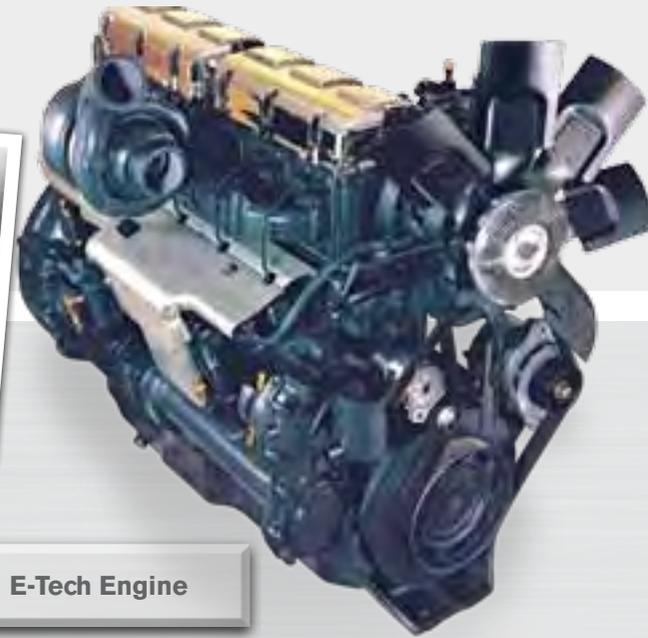


- 1965 Hagerstown hosts its first family-day picnic with 9,300 attendees.
- 1966 Hagerstown designs the first four engine emissions test cells for the Engineering & Research building.
- 1967 Signal Oil Company acquires Mack Trucks, Inc.



"The reality is... we powered the trucks that moved the goods, that built the highways, built the bridges, built the factories, built the homes for much of America"

Roger Johnston  
Hagerstown 3/1/1999 - 12/14/2007



E-Tech Engine

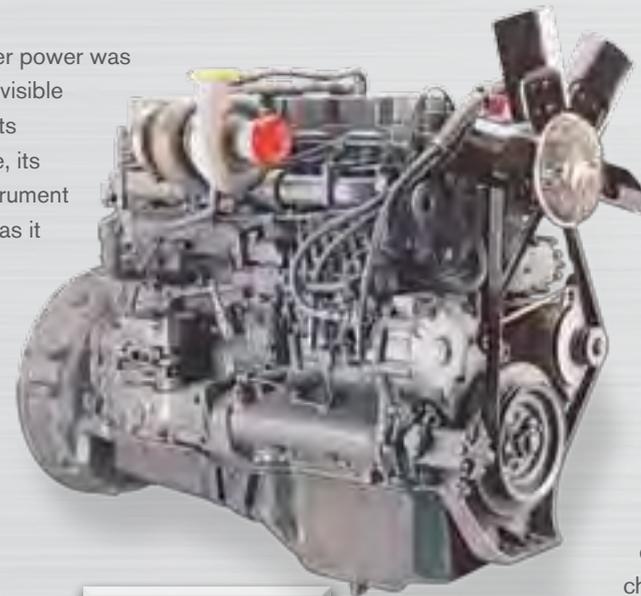
## The Drive To Innovate

The arrival of the 1970s confronted Powertrain engineers with new pressures to exercise their creative muscles. For the next 30 years, the development of truck power would not only compete for leadership in responsive, efficient power for customers but also face a succession of strict deadlines that were created to satisfy a new generation of emissions controls.

In 1970, the first step toward cleaner power was based on a relatively simple test for visible smoke. Powertrain not only earned its Engine Smoke Emissions Certificate, its engineering also devised a new instrument for measuring the opacity of smoke as it left the exhaust stack.

At the same time, development continued to make Powertrain the first engine manufacturer with its own engine compression brake. A project, initiated in 1969, led to our patent for the Dynatard® engine brake in 1971.

Powertrain's commitment to advanced engine technology led to a \$100 million upgrade and expansion of the Engine Development Lab in 1972.



E7 Engine

The following year was the last for our gasoline engines, as development turned fully to diesel. This focus on enhanced diesel performance and efficiency resulted in the industry's first successful engine-mounted air-to-air intercooler.

In 1977, Powertrain pushed diesel power to meet the needs of extreme military applications with the E9 V8 engine. Introduced with up to 750 HP, it was later fitted with four turbochargers to reach 1500 HP.

By 1980, the cost of diesel fuel was rising, making fuel efficiency a priority for many customers. The Econodyne® series provided the improved fuel economy that the customers demanded. With a two valve cylinder head and chassis-mounted charge air cooler, the E6 Econodyne could generate up to 350 HP and the next year, the E9 V8 model offered a fuel saver with up to 500 HP.

Breaking ground on a \$100 million upgrade to the Engine Development Lab in 1972.



Redesigned with a four-valve cylinder head in 1984, the Econodyne became the fuel smart option for many truck fleets.

Powertrain's response to the tough 1991 EPA emissions levels was the E7 series of 12-liter engines at 728 cu. in. for which Hagerstown was ready with its first production build in 1988. Ranging from 250 to 425 HP, the E7 engines boasted the industry's best horsepower-to-weight ratio.

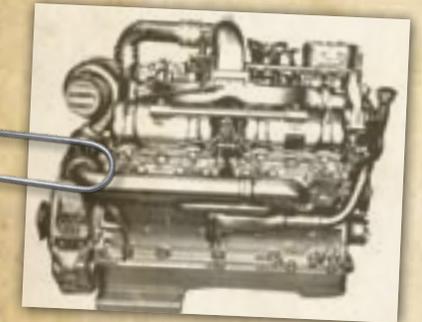
Powertrain's first electronic engine control system developed in 1990, led the industry to more innovations such as cruise automatic resume, dual-power-take-off (PTO) capacity and a patented variable injection timing system registered Econovance®. The engineering team quickly followed up in 1991 with the high swirl/moderate high injection pressure combustion system. By optimizing the mix of fuel and air, this system gave the E7 and E9 engines more efficient combustion providing customers new fuel savings, lower emissions and longer intervals between oil changes.



ASET AC Engine

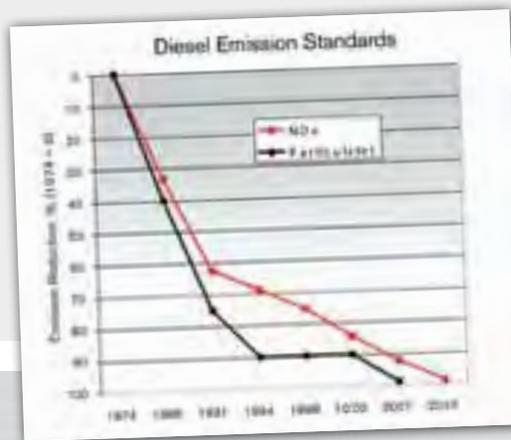
## HAGERSTOWN POWERTRAIN TIMELINE

- 1967 Hagerstown donates land for construction of Boy Scouts Service Center. 
- 1967 Hagerstown installs first numerically controlled machine.
- 1967 Hagerstown initiates the Cost Reduction Suggestion program.
- 1967 Hagerstown debuts revolutionary Maxidyne® constant HP diesel engine along with the Maxitorque® transmission.
- 1968 Hagerstown employees form the Bulldog Federal Credit Union. 
- 1968 Hagerstown receives an E flag for Export Excellence from U.S. Department of Commerce.
- 1969 Hagerstown introduces the Maxidyne ENDT865, the first V8 in the series.



- 1969 Mack is the first heavy-duty diesel engine manufacturer of the day to produce its own engine compression brake.





By 2010, diesel truck engines would have near-zero output of all regulated emissions.

### Cleanest. Greenest. Best.

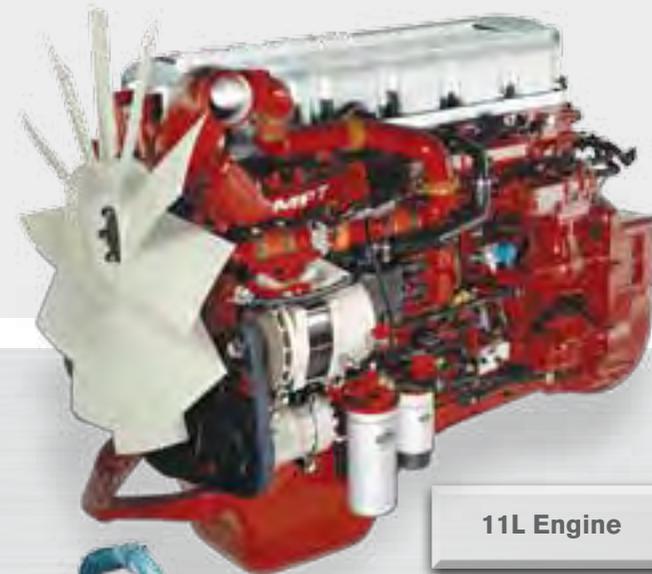
The E7 E-Tech® diesel engine brought together an impressive array of Powertrain technologies to meet the 1998 U.S. EPA standard: the electronic unit pump (EUP), fuel-injection, V-MAC® total vehicle electronics, high swirl injection combustion, turbocharged, chassis-mounted charged air cooled, and direct injection. E-Tech was available with 275 to 460 HP and was offered in three engine families - Econodyne®, Maxicruise®, and Maxidyne® - all available with 275 to 460 HP. Also introduced in 1997, the E9 V8 military engines for Mack and Renault VI achieved a 50% increase in horsepower up to 750 HP.

The engineers behind Powertrain engines faced their toughest deadlines and most ambitious emissions targets following the EPA Consent Decree of 1998. Utilizing two new exhaust gas recirculation (EGR) technologies, Powertrain met the EPA requirements with two versions of the ASET® (Application-Specific Engine Technology) engines. For highway trucks, ASET AC engines would use externally cooled EGR controls, while ASET AI engines for vocational applications were given EGR controls with internal cooling.

ASET engines offered customers additional innovations for economy and performance. CCRS (current controlled rate shaping) is a patented



13L Engine



11L Engine

powertrain fuel injection control that improved fuel economy while reducing emissions. Advances on the Dynatard compression brake resulted in better performance, higher reliability and lower cost, leading to another new patent, branded as the PowerLeash™ engine brake.

The source and technology of truck power took a new turn in 2005 when the U.S. Air Force awarded a development contract for hybrid diesel and electric drive vehicles.

The four-year project led to the delivery of the first hybrid power for refueling trucks and, subsequently, for USAF refuse trucks.

EGR emission controls were enhanced to meet stringent 2007 particulate and NOx regulations for the new Volvo Group global engine platform. Deployed from 2005 to 2007, the new system was the first to use ultra-low sulfur diesel fuel and a diesel particulate filter (DPF).



EPA 2010 SCR technology

Products from Hagerstown's engine assembly lines included Mack MP7 (325-405 HP) and MP8 (415-485 HP) models; Volvo D11 (325-405 HP) and D13 (335-485 HP) models as well as subassembly for the Volvo D16 (450-600 HP) engine.

Finally, in 2010, Powertrain was credited as the first diesel engine manufacturer to be certified compliant with 2010 EPA and CARB (California Air Resources Board) regulations. With near-zero emissions utilizing our latest application of Selective Catalytic Reduction (SCR) technologies, Powertrain engines are among the cleanest in the world. And more importantly, they substantially increase fuel savings, extend service intervals and improve dependability.

A milestone on our development technology journey, the work behind this new technology was performed in our Engine Development Lab. Using the Reliability Growth Management (RGM) process, we are proud to stand behind the most validated product in the 50-year history of this Hagerstown facility.



## HAGERSTOWN POWERTRAIN TIMELINE

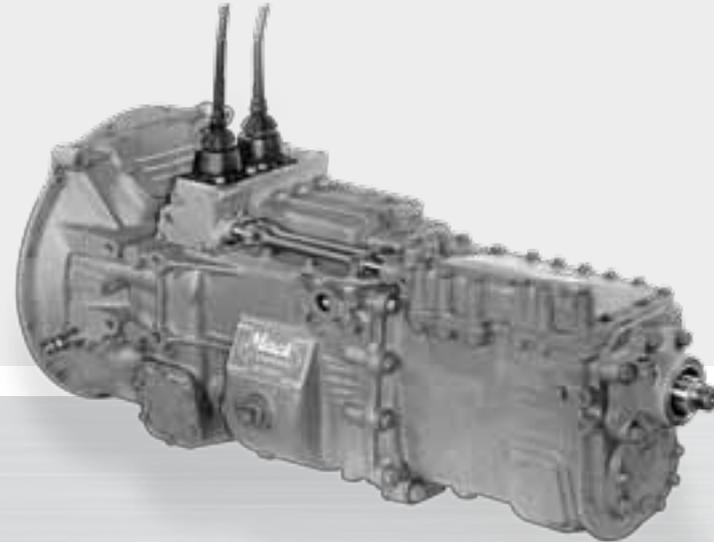
### 1970s

1970 - U.S. Environmental Protection Agency initiates the first Engine Smoke Emissions Certification program, and Hagerstown quickly receives its first EPA certificate.

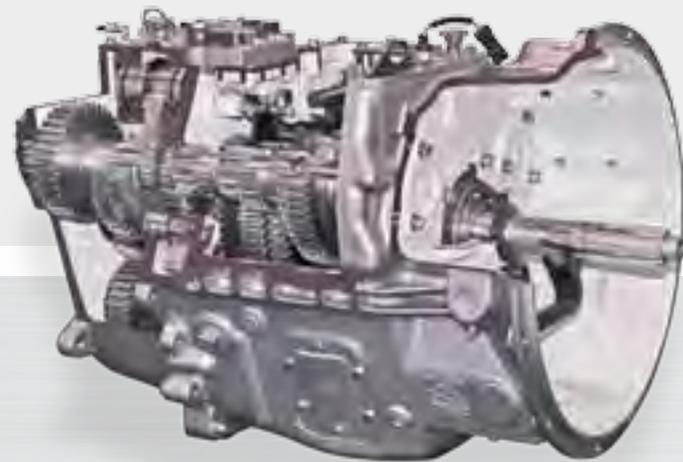


- 1971 Mack patents its Dynatard® integrated engine compression brake.
- 1972 Mack invests \$100 million for upgrades and expansions of Hagerstown's Engine Development Lab building.
- 1972 Hagerstown builds Mack's transfer case, the first "full time" all-wheel-drive transfer in the truck industry.
- 1973 Hagerstown builds final gasoline engines.
- 1973 Mack introduces its first engine-mounted air-to-air intercooler.

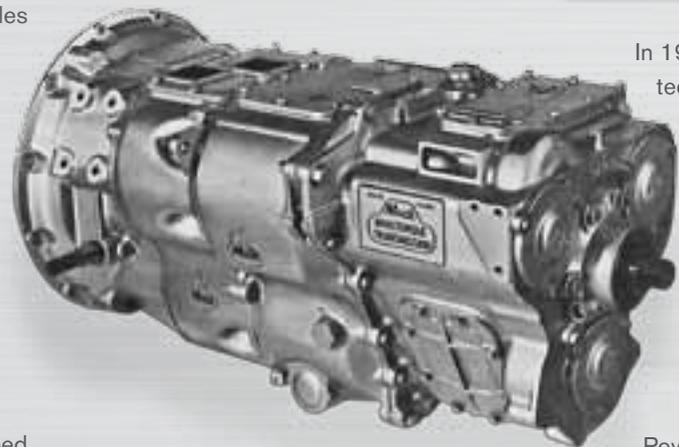




**TR Transmission**



**T200 Transmission**



**TR107 Transmission**



**T300 Transmission**

"AS A DESIGN ENGINEER, I WORKED ON A DRAFTING BOARD. THEN CAD WAS BEING INTRODUCED BUT IT STILL STARTED WITH SOMEONE WITH A PAPER AND A PENCIL TO SKETCH SOMETHING, AND THEN ENTER IT INTO THE SYSTEM."  
**DICK SCHNURR**  
 1/29/1962 - 1/1/2005

## Power To The Ground

Complete drive systems matched to the vehicles they power has always been a distinguishing hallmark of Powertrain products. Our product development is built on a foundation of hands-on experience with the performance and production of every component -- from engine to axle.

Hagerstown inherited the machining and assembly of Mack Triplex (TR) 15-speed and Quadruplex 20-speed transmissions from the former facility in Plainfield, NJ in 1961. The Unishift duplex transmission soon followed with its improved control of a 10-speed splitter along with a single-shift lever and a flipper-valve actuating a full air-powered shift cylinder.

CRD rear axle carriers production began in Hagerstown in 1962. From 1962 to 1987, more than one million of these durable rear ends were delivered.

In 1964, advanced gear-cutting technology from Powertain engineering allowed production of a new style of axle gears that led the industry for strength and long life. The Durapoid spiral bevel axle gear has a buttress-shaped tooth which provides greater bending strength on the drive side with reduced end loading in the tooth under heavy load.

Powertrain introduced aluminum carriers as an option in 1966, offering customers a simple way to reduce the weight of their trucks, and increase payloads and thus productivity by as much as 260 lbs. per trip.

### The Maxitorque era

Hagerstown launched the Maxitorque truck transmissions in 1967 as part of an integrated power strategy with the new Maxidyne engines. The combination maximized horsepower at low speeds, saving operators from shift fatigue while saving fuel and dollars for fleet owners. The TR107 series was the first triple countershaft five-speed transmission. Its compact design shortened the transmission's overall length by a third, reducing weight and allowing greater design freedom. Its aluminum case also contributed to making the TR107 significantly lighter than comparable transmissions while still delivering the highest torque in the industry.

In order to further increase the profitability of every trucker, Powertrain introduced an all new family of triple countershaft overdrive transmissions to replace the TR107 series in 1983. The T200 series was even lighter, stronger and shorter than its predecessor, and designed to complement the new lower speed, fuel efficient Maxidyne-Plus engines. Nine and ten speed versions included synchronized air shift compounds for full range shifting. A year later, the transmission was updated with an innovative case featuring an integral clutch housing. This novel one-piece case and clutch housing not only improved component alignment, it also reduced production costs.

The T300 series, the current generation of transmissions in the Maxitorque tradition was brought to market in 2001, offering all new 10-speed models for both highway and vocational applications.

## HAGERSTOWN POWERTRAIN TIMELINE



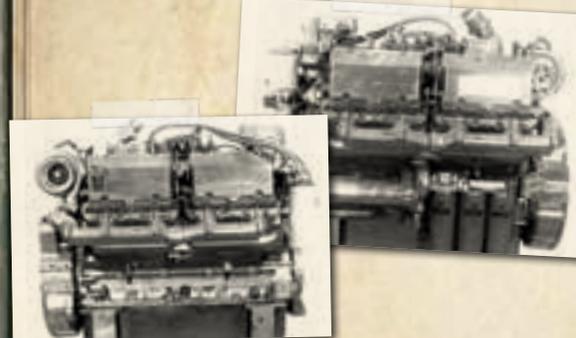
**1973** - Mack invests in Hagerstown for a new high-rise warehouse and additions to the heat treat process.

**1975** Mack introduces the top transmission gear road speed governor.

**1975** Mack launches rear-drive PTOs.

**1976** Mack introduces the ET1005 360 HP V8 engine, the largest cubic displacement delivered to date.

**1977** Mack introduces the ETD1005E9, 425 HP 4-valve head engine.



**1979** Renault VI purchases a 10% stake in Mack Trucks, Inc., including its interest in the Hagerstown facility.





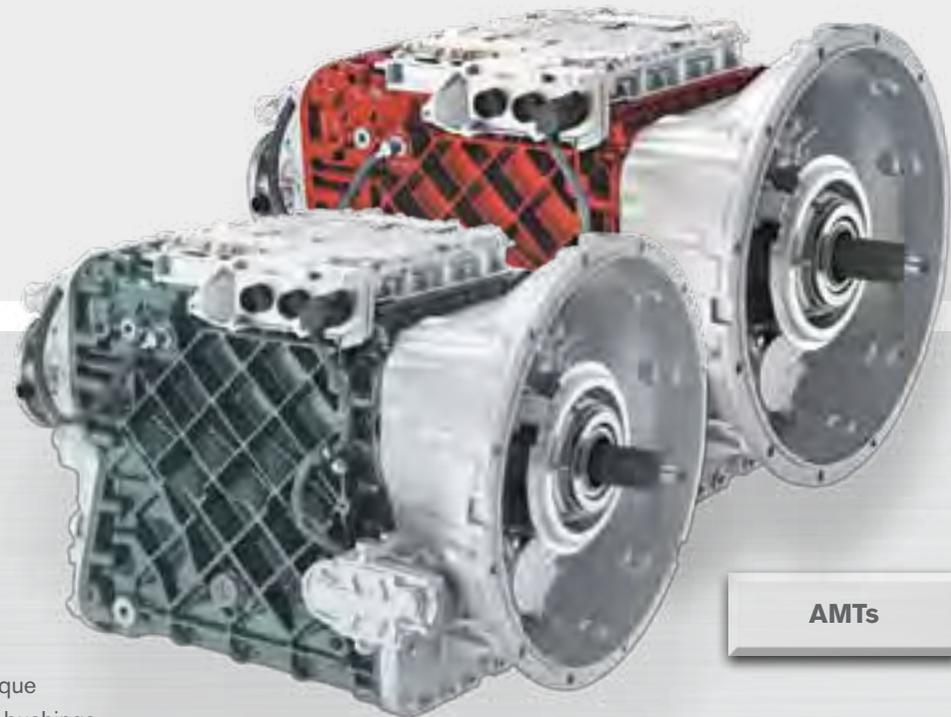
## Ideas In High Gear

Along with the development of major product lines, innovations from Powertrain included improvements to numerous components. In 1970, our engineers provided Mack trucks with a practical, long-life wet clutch patented the Dynamax® clutch. In 1972, they delivered the industry's first full-time all-wheel-drive transfer case. With its patented torque proportioning center differential, it eliminated pinion shafts and bushings and provided automatic biasing that retarded differential spin-out. The design was so successful, it continued in production for more than 30 years.

In 1975, Hagerstown once again took a leadership role as it related to the fuel economy of Mack trucks. They developed a top transmission gear road speed governor. This development utilized the "gear-fast-run-slow" principle but set a limit on top speed. In the same year, the engineering team unveiled a transmission rear-mount PTO that offered customers the option of driving PTO equipment directly from the ends of any of the three transmission countershafts.

Powertrain updated its road speed governor in 1986 to replace its mechanical operation with electronic controls. Unlike its predecessor, the electronic Maxi-Miser would operate independently of the transmission's gear position.

Customers in 1987 welcomed the production truck transmission with a large 33:46 overall ratio range. The T2080 transmission offered the low end in forward and reverse as required for extremely slow speed construction work as well as other off-road vocations.



AMTs



## Geared up for today

2007 ushered in a new generation of driver-friendly operations. Powertrain introduced America to the automated manual I-Shift transmission (AMT) that had already proven highly popular with Volvo customers in Europe. Highly-anticipated by Volvo fleets in the U.S., I-Shift's 12-speed, two-pedal system has quickly gained wide acceptance for its ease of operation and smooth shifting performance. AMT transmissions are assembled in the Volvo Powertrain facility in Köping, Sweden and then Hagerstown performs grooming and electronic testing for U.S. applications.

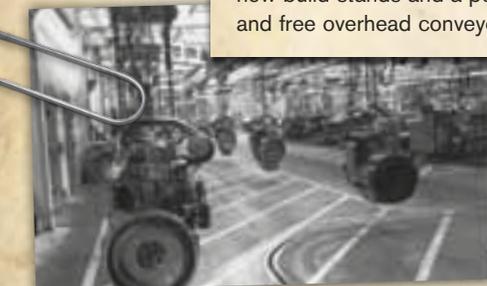
The success of the I-Shift led to the launch of a Mack version of the AMT, now known as *mDRIVE™*, in 2010. Clearly a product whose time had come, *mDRIVE* was hailed by industry experts as "one of the most innovative new products" of the year.



"IT WAS A BIG FAMILY...WE HAD OUR UPS AND DOWNS, BUT IT WAS THE PEOPLE IN HAGERSTOWN WHO BUILT THOSE ENGINES AND THOSE TRANSMISSIONS AND MADE SURE THEY WERE THE BEST THEY COULD BE."  
 JIM STEWARD  
 4/9/1962 - 6/1/2000

## HAGERSTOWN POWERTRAIN TIMELINE

1979 - Hagerstown updates the engine conveyor system; additions include a new conveyor to feed the two lines, new build stands and a power and free overhead conveyor.



### 1980s

- 1980 Hagerstown installs two robots in crankshaft production to replace hand deburring stations; new grinding cells are added along with induction hardening and stress relieving furnaces.
- 1980 Hagerstown expands the plant to the south and east of the original facility, adding 36 production test cells, an overhead conveyor system and two robotic painting units.
- 1981 Mack's E6 Econodyne® series introduces chassis-mounted charge air cooling to the truck market.
- 1982 Renault VI increases its share in Mack Trucks, Inc. to 20%.



# POWER AND PRIDE

The Powertrain facility in Hagerstown was first envisioned as a showplace in automotive manufacturing, utilizing the best methods and processes of the day to build engines and powertrain components for the world's best-built trucks. From the first day, the legacy of "Built Like a Mack Truck®" set a standard and a sense of pride that every Hagerstown employee would carry forward for each of the facility's 50 years.

## Transformed

While the machinery and facilities at Powertrain continuously evolve and improve, our traditional work ethic and pride also advance constantly under the Volvo banner. With the completion of our formal "Transformation" process in 2007, Hagerstown is once again a state-of-the-art manufacturing facility, supported by the best technology and the best people. Through generations of dedication to our craft, Hagerstown truly earned its place today as the Volvo Powertrain "Center of Excellence" in North America.



## HAGERSTOWN POWERTRAIN TIMELINE

- 1982** Mack announces the new Maxidyne-Plus low-speed, high torque-rise engine.
- 1983** Renault VI increases its share in Mack Trucks, Inc. to 30%.
- 1983** Mack introduces the T200 transmission, the second generation of the Maxitorque series.
- 1983** Hagerstown delivers its first drive system for the Renault FR1 coach.
- 1984** Hagerstown wins the State of Maryland's highest recognition: the "Bill Pate Award for Outstanding Economic and Civil Contributions to the State."
- 1984** Mack introduces the E6 engine in a four valve head design.
- 1984** Mack introduces the Centrimax® centrifugal cartridge-type oil filter, extending engine service intervals.
- 1985** Mack introduces its E9 engines at 500 HP with turbocharging and aftercooling.
- 1986** Hagerstown delivers the V8 engine that powered the 1,000,000<sup>th</sup> Mack truck.





One of the two powered slat conveyors used when the plant opened.

Engine assemblers working on the "A" Roller Conveyor assembly line.



Since 2006, AGV units have replaced slat conveyors, giving assemblers far more freedom to move cylinder blocks into the optimal work position quickly and comfortably.

## All The Right Moves

### Engine Assembly - Then

Engine assembly relies on fast, efficient methods of moving machined cylinder blocks through a complex sequence of installations and adjustments. When the Hagerstown plant opened, the heart of the line was two powered slat conveyors, #1 and #2, which transported the cylinder blocks to build stands that could be adapted to different engines. An overhead bridge crane made the transfer from Conveyor #1 (upper) onto Conveyor #2 (lower), then the assembled engine was loaded onto dollies for transport to engine test.

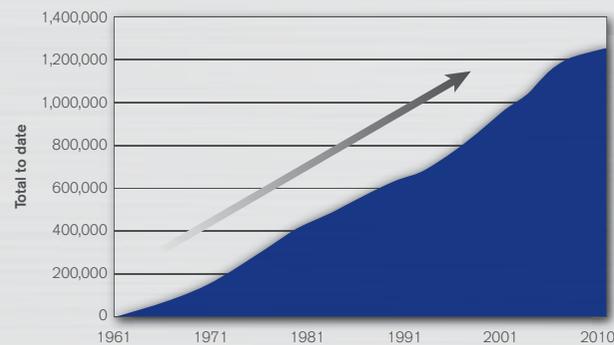
In 1979, the assembly process was updated with a new roller-type conveyor feeding the slat conveyor system, which was refitted and equipped with redesigned build stands. The lines were renamed Conveyor "A," "B," and "C". Engine test dollies were replaced by a power and free overhead conveyor system, eliminating much of the lifting required by the old method.

Until the late 1980s, these lines did all the assembly for both 6-cylinder and V8 engines. V8 assembly was then relocated to its own roller conveyor assembly line.



### Hagerstown Engine Build History

1,246,646 engines (1961-2010)



### Engine Assembly - Now

Today, automation plays an essential role in both moving and assembling our engines. Mechanical conveyance systems on the Basic Line advance the cylinder blocks through robotic stations that perform numerous critical and repetitive assembly operations.

The partially assembled engines are loaded mechanically onto in-floor wire-guided Automated Guided Vehicle (AGV) units. AGVs allow Final Zone assemblers to position the engine vertically, horizontally and through 360° of rotation to achieve the most efficient and most comfortable working position. With this flexibility, the AGV can bear all the weight of both the cylinder block and parts to be fitted as the worker completes each task. Assemblers have no need to bend or strain as they work, adjusting their work station to suit their needs and preferences for every step.



## HAGERSTOWN POWERTRAIN TIMELINE

- 1986** Mack introduces its first pedestal front engine mount.
- 1987** Mack's new T2080 transmission is the first with an extra wide range gear ratio at 33:46 overall.
- 1987** Hagerstown employees construct "Grief Relief Park", an on-site outdoor area for fun and relaxation.



- 1989** Mack introduces the E7 series of 12L 6 cylinder engines, offering 16 different engines from 250 to 454 HP.
- 1989** Renault invests \$100 million in Hagerstown for equipment modernization program to support production of the E7 series.





Technicians connect and monitor engines at our original production test stands.



## Tested and True

### Production Verification - Then

Quality and consistency have always been shared values among the people who produce Hagerstown powertrains. Evolving test methods have been a critical part of our history of continuous improvement.

For our first 20 years, engines were tested 'hot' – filled with oil, fuel, and coolant, then tested by dynamometers. Our original test included 22 test stands and operator consoles in one large room. A towveyor delivered assembled engines to test mounting plates on four-wheel dollies, where jacks elevated the block into position with a drive shaft. The drive shafts linked the engines to dynamometers housed in a separate enclosure.

In 1980, the test area was replaced with 36 new test cells, each a sound-proofed enclosure with its own bedplate and dynamometer.

The towveyor and dolly system was retired and a power and free overhead conveyor installed. Technicians operated from a console outside the cells with remote computer controls. Engines were tested, collecting data for more than 50 parameters that define the unique fingerprint or "DNA" of every engine.

In 1980, production verification shifted to 36 self-contained cells conducting 'hot' engine tests.



"WHEN I FIRST WENT INTO TEST, I EXPECTED TO FACE SOME RESENTMENT IF I TOOK A PROBLEM TO THE LINE, BUT I FOUND THE OPPOSITE WAS ALWAYS TRUE. EVERYONE WAS EAGER TO HELP OUT SOLVING THE PROBLEM."

Tom SWEENEY  
12/11/1961 - 6/1/2000



### Production Verification - Now

Today, the 'hot' test cells remain in use only for audit purposes. A state-of-the-art end of line verification system known as Quality Enhanced Products and Processes (QEPP) confirms the assembly has been properly completed and the engine is fit to ship. The fuel and fluid systems are pressurized to check for leaks. An electrical harness which replicates a chassis electrical system is connected to the engine, checking for electrical shorts and continuity as well as sensor functionality. Following, the oil system is filled under pressure which not only ensures lubrication is present throughout the engine upon start-up but also creates a fill pressure signature which is automatically compared to a master signature. The final step places the engine in a 'warm' test cell which starts and operates the engine in an unloaded condition. From the voltage pull when the starter is cranked to injector firing pulses, over 1000 separate test parameters are monitored and checked in just under four minutes before the engine forwards to Paint.



## HAGERSTOWN POWERTRAIN TIMELINE

### 1990s

- 1990** Mack Trucks, Inc. becomes a wholly-owned subsidiary of Renault VI.
- 1990** Mack introduces the new V-MAC® electronic engine control system, an unprecedented level of control in tailoring performance options to specific requirements. The V-MAC system leads the industry with such innovations as cruise auto-resume and dual-PTO capability.
- 1990** Renault and Mack patent a unique, electronically controlled, variable-injection timing system developed in Hagerstown designed exclusively for the E7 series of engines; the Econovance® timing system optimizes fuel efficiency and lowers emissions.
- 1991** UAW organizes the Local 1247 Engineering Bargaining Unit.
- 1991** Mack develops the "High Swirl/ Moderately High Injection Pressure" combustion system to optimize the mixing of diesel fuel and air in its E7 and E9 engines.
- 1992** Hagerstown introduces "HIP" valve lifters, providing extended operational life for valve lifters while improving quality performance in production.





During the 1960s and 1970s, crankshafts were deburred by hand at individual deburr benches.

Two robots took over deburring operations in the 1980s. The robotic system was retooled in 2000.



The camshaft department became a fully automated line as part of Powertrain's "Transformation" process.

## Speed and Precision

Market demands for more power, increased efficiency and lower emissions have all contributed to the need for ever-greater precision in machined components. The ongoing evolution of new materials and technologies has opened opportunities for Powertrain machining processes to respond with continuing improvements to hone our competitive edge.

### Crankshaft Machining - Then

Machining in Hagerstown relied on the labor of skilled machinists. Rough forgings were suspended vertically from a floor-mounted monorail system, and pushed to work stations by hand. Operators picked crankshafts off the monorail with a hoist and loaded them into their machines horizontally. Each crank was painstakingly deburred by hand at numerous deburr benches.

In the 1980s, two new deburring robots were introduced to the crankshaft department. The upgrade also included new induction hardening equipment for treating the metal and new grinding cells for the final machining of main and pin journals.



### Crankshaft Machining - Now

The crankshaft line was renewed again in 2006, with new roughing and finishing machines served by an automated overhead gantry system for loading and unloading. Much of the existing equipment, including the deburr robots, hardening furnaces, grinders and other machines, were retooled producing cranks for the new heavy-duty engine platforms.

### Camshaft Machining - Then

For much of our history, Powertrain camshafts were machined in the same area as our crankshafts. Operators pulled rough stock from tubs and placed hand-stamped finished parts onto skids with dividers. In 1998, a new department was created exclusively for camshaft production. As E6 engines made from forged steel blanks were phased out, our machines were retooled for the E-Tech camshaft made from bar stock blanks. Preparations for the new product included the addition of new machines such as the end mills, drills, groover, transfer line, stamper, lobe milling machine and induction hardening equipment machine.

### Camshaft Machining - Now

Through the "Transformation" process initiated by Volvo, another phase of retooling heralded the end of the E-Tech line and the beginning of the camshafts for the new global engine platform. Extensive upgrades included an induction hardening machine, another lobe milling machine, two lathes, a straightener, a lapper, roll scan, gantry systems and additional robots. With all the new equipment set in line, the process became fully automated to the point where the rough material is loaded into the first operation and final camshafts then delivered from the last operation.



## HAGERSTOWN POWERTRAIN TIMELINE

**1994** Hagerstown receives the U.S. Senate Award for Productivity & Quality.



**1995** Hagerstown produces the 700 HP E9 engines for use by the French Army in its tank retriever vehicles.



**1995** Hagerstown exports 3/4 engines to Renault VI for completion and installation in their Magnum trucks.

**1995** Mack offers a new REPTO (rear engine power take off) for applications needing live power.

**1995** Hagerstown is registered under the ISO 9001-2000 quality protocol.

**1996** Over \$28 million is invested in Hagerstown's engine manufacturing operations in advance of production of the new E7 E-Tech® engine to meet 1998 emissions standards.

**1997** Hagerstown produces the E-Tech 12L 6 cylinder engine with V-MAC III electronic controls.



RENAULT



"In the early 60's, I might set up a machine tonight for a man to run 50 or 60 pieces, then be back later to set up something else. As we got going, we could run larger lots... the cycle times are much faster now; you can do so much more to be competitive."

**Gary Davis**  
9/16/1962 - 7/1/2003



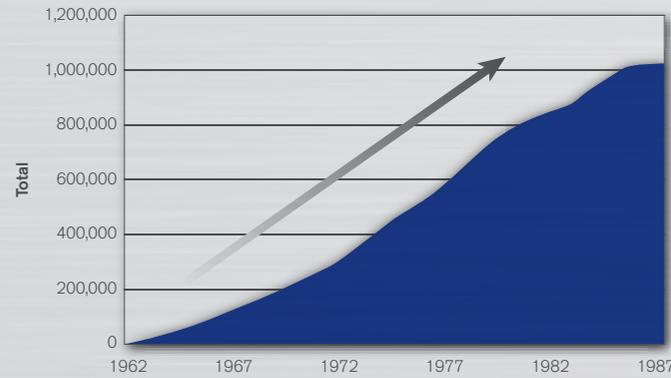
## Geared Products Machining

### Then & Now

Originally, annealing of the rough forgings as well as turning and gear cutting operations was performed in the transmission and carrier area by employees who performed individual operations. Heat treating was and still is performed for the hardening, tempering, straightening, shot blasting and shot peening operations before the final operation of honing and grinding. The main cases and rear box housings were processed with dedicated machines until the 1980s, and today the process is now completed in automated tool-changing CNC machining centers. Since the 1990s, employees perform multiple operations in machine cells to produce gears.



**Hagerstown Carriers Build History**  
1,017,522 carriers (1962-1987)



## Transmission Assembly

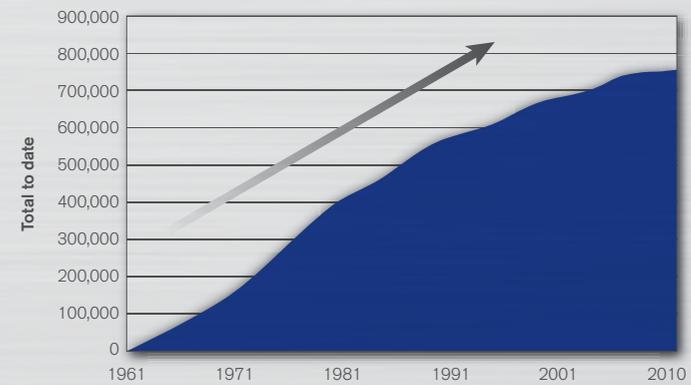
### Then & Now

Transmission line employees of 50 years ago would be right at home in our facility today, as the careful and precise assembly processes have remained largely unchanged since then. The simplicity of the line itself has allowed the facility to adapt to all of the new geared products developed here since our inception in 1961.

However, the physical environment that awaits returning employees would be a welcome change. Improvements in such key areas as quality control, ergonomics and logistics are now implemented to optimize the working conditions for our employees and to meet if not exceed the expectations of our customers.

The most evident change in our transmission assembly operation is the new addition of *mDRIVE* and I-Shift automated manual transmission grooming and electronic testing for our Mack and Volvo truck brands.

**Hagerstown Transmissions Build History**  
760,081 transmissions (1961-2010)



## HAGERSTOWN POWERTRAIN TIMELINE

- 1997** Mack introduces the E7G engine, fueled by liquid natural gas (LNG).
- 1997** Hagerstown exports two new E9 engines -- a 750 HP military model for the AMX-30 tank and the EA9-610 for use in Australia.
- 1997** Mack is certified to meet 1998 emissions criteria with the E-Tech engine platform.
- 1998** EPA issues its Consent Decree to heavy-duty engine manufacturers, establishing lower NOx emission levels and accelerating the timetable for new EPA and CARB standards.
- 1998** Hagerstown introduces its first in-process verification systems (IPVs) in manufacturing.
- 1999** Hagerstown employees form the Medical Emergency Response Team (MERT) with volunteers from the Fire Brigade.
- 1999** Mack Power launches the industrial and marine division.



### 2000s

- 2000** Hagerstown joins in celebrating the 100-year anniversary of Mack Trucks.





*"Transformation is the term they used at the time. It was our opportunity to transform what we had been to what we've become."*  
**Dennie Hollinger**  
 6/30/1969



## The Finishing Touch

### Paint Process - Then

The pride of Powertrain is reflected in the meticulous attention given to the final painted finish of its products. In the early days, both engines and transmissions from Hagerstown received careful hand finishing in the paint department. Transmission painting was discontinued in the 1970s when aluminum cases replaced cast iron.

Each engine was individually finished by a single skilled paint technician. Engines were delivered to paint directly from the test cell area on towveyor carts. The paint technician lifted the engine from the towveyor with an overhead bridge crane to transfer it into a stand-alone paint and drying booth. The paint technician then fully prepped and painted the unit using hand-operated equipment.

### Paint Process - Now

Painting has become a highly automated process, although each engine still gets the personal touch of a Hagerstown technician. Engines from the test cell areas are cleaned and prepared by operators before being transported to and through the enclosed paint booth and a downdraft drying booth. Since 1980, two robotic units have completed most of the engine painting within the booth. The robots were updated in 1983 and again in 1998. Paint technicians perform the engine's final grooming steps before it is delivered for shipment.



## A Varied Legacy

### Historical products from Hagerstown

In its early years, the Powertrain facility produced a vast number of its own parts and components for powertrain systems. The cylinder block line was 1/4 mile long, and at one point in time, more than half the manufacturing footprint was involved in gear manufacturing and component machining. Outsourcing selected parts has allowed Hagerstown to narrow its focus on the quality of the finished product while increasing its competitiveness. Our varied experience still provides a foundation of insight for product development and special projects.

### Components Manufactured or Assembled at Hagerstown - 1961-2011

- |  |                             |                      |
|--|-----------------------------|----------------------|
| • Axle Carrier Components                | • Cylinder Heads            | • Oil Pumps          |
| • Axle Components for Off-Highway Trucks | • Engine Clutches           | • Rear Axle Carriers |
| • Bearing Caps                           | • Exhaust & Inlet Manifolds | • Shift Rails        |
| • Bearing Retainers                      | • Flywheels                 | • Rocker Arms        |
| • Clutches                               | • Flywheel Housings         | • Shifter Covers     |
| • Connecting Rods                        | • Fuel Lines                | • Shifter Forks      |
| • Covers                                 | • Hoses                     | • Timing Gears       |
| • Cylinder Blocks                        | • Hydraulic Cylinders       | • Transmission Cases |
|  | • Machined Parts            | • Valve Lifters      |
|  |                             | • Water Pumps        |

## HAGERSTOWN POWERTRAIN TIMELINE

- 2001** Volvo AB purchases Renault VI and, with it, acquires Mack Trucks, including Powertrain in Hagerstown.
- 2001** Hagerstown delivers the first T300 series transmissions, introducing all new 10-speed models for highway and vocational applications.
- 2002** Mack introduces the Application-Specific Engine Technology, ASET® engine family, in response to the latest emissions regulations from EPA.
- 2003** On July 23, Hagerstown builds the 1,000,000<sup>th</sup> Mack engine. Assembly workers recognize the milestone by signing their names to the engine as it advances up the line.



Employees celebrate the millionth engine built in the Hagerstown facility.

- 2003** October 9: Volvo announces that the Hagerstown facility will be the global manufacturer's "Center of Excellence" for North America.

# BUILDING A BETTER, GREENER WORLD

## Taking Up The Challenge

For more than 30 years, the rigorous pursuit of increasingly stringent EPA standards has led Hagerstown engineers to a wide range of innovative solutions. Our engineers recognized that the job of every Hagerstown employee depended on their ability to deliver clean power. Our distinctive powertrains demanded equally unique designs for emissions control. Year after year, they met every challenge. Today, we take our place at the front of the line with Volvo as worldwide pioneers in environmental care.

## Beyond “Compliance”

Powertrain management and staff have long recognized the social and economic value of recycling. Reclaiming metals, including aluminum, steel, tin, and cast iron has been part of our process from the outset, capturing scrap metals as varied as lathe turnings and obsolete production machines.

The Volvo core values of environmental care instills in us a high awareness of our environmental footprint. This value guides every aspect of our daily life, from outside purchases to the plant floor.



Powertrain has been honored for minimizing pollution from its facility that could impact the environmentally sensitive Chesapeake Bay, the largest estuary in the United States.



## HAGERSTOWN POWERTRAIN TIMELINE

- 2003** Hagerstown ends production of the Mack V8 engine.
- 2003** U.S. Air Force awards a \$2.5 million contract to Hagerstown for development of a hybrid electric and diesel powertrain for use in tankers to refuel aircraft.
- 2003** Mack unveils the new PowerLeash™ integrated engine compression brake.
- 2004** Hagerstown formally changes its name to Volvo Powertrain North America (VPT NA). 
- 2004** Hagerstown assembles the first Volvo engines in North America beginning with the D12.
- 2004** Hagerstown's \$150 million “Transformation” begins and includes a variety of upgrades and capital investments within the existing structure as well as the construction of a new, world-class Engine Development Lab (EDL).
- 2004** October 8: Hagerstown breaks ground for the EDL with the attendance of state and federal dignitaries, the Swedish ambassador to the United States and officials from Volvo Trucks, Mack Trucks, the EPA and the UAW.
- 2005** Volvo Group introduces the new global heavy-duty engine platform and the Mack MP7 is introduced in Hagerstown.
- 2006** Hagerstown's engine lineup is expanded with the D16 engine for Volvo Trucks.
- 2006** Hagerstown's new \$40 million state-of-the-art Engine Development Lab opens.

**VOLVO**

"CUSTOMERS LIKED OUR ENGINES BUT, IF WE DID NOT MEET EMISSIONS REGULATIONS; IF WE DID NOT HAVE COMPETITIVE ENGINE EFFICIENCY, THE PLANT WOULD CLOSE! WE WERE ALWAYS IN SURVIVOR MODE. YOU CIRCLE THE WAGONS AND WORK TOGETHER."

KEN MURPHY  
9/28/1970 - 3/1/2007

Powertrain has been developing hybrid diesel power with the U.S. Air Force since 2002.



## Reduce. Reuse. Rethink.

Volvo Powertrain engines lead the industry with technology that meets or exceeds current EPA Regulations. Our engines boast high efficiency EGR, DPF and SCR systems (see back gatefold), with a proven ability to operate with ultra-low sulfur diesel fuel. Powertrain was proud to deliver North America's first diesel engines to be certified under EPA 2010 Engine Specifications.



- Roofing insulation was replaced with a fireproof 180 mm material, raising its "R" factor from R-4 to R-18.
- Shutting down three steam boilers formerly in the powerhouse and replacing with hot water boilers in the plant and engineering lab, resulted in a 76% reduction of our oil and natural gas consumption.

Environmental care is not only built into the products we manufacture; it's an ingrained part of the processes we use to build them.

In 2002, a cross-functional team was assembled to begin formalizing our Environmental Management System (EMS). Within the year, our EMS was successfully audited and was recommended for ISO 14001 certification in record time.

The extensive improvements to the Hagerstown facility attributable to our Transformation Process resulted in many environmental upgrades:

- New energy-efficient units replaced six large air compressors in the powerhouse in 2006.
- From 2004 to present, numerous air hoists and air tools have been replaced with more precise electronic tools.
- Column ventilators and roof exhaust fans once used to cool the facility were updated with central air handling units providing filtered and tempered air to the newly transformed areas.
- New low-energy T-5 fixtures have replaced fluorescent and metal halide overhead lighting



Until 1986, volatile liquids used in production, such as fuels, oils and cleaning fluids, were stored in underground tanks. The tanks were then replaced with safer, more accessible double-walled tanks installed above ground in our enclosed diked tank farm.

Powertrain makes every effort to conserve the value and energy of our materials. In addition to the scrap metals, our recycling programs have grown to keep a vast range of materials out of landfills, from cardboard, papers and ink cartridges to machine coolants and cutting oils, batteries and aerosol cans.

The wooden pallets we receive with shipments of parts and supplies are typically in good condition but are not required for our own shipping needs. In 2002, Powertrain established a partnership with a local shipping company to reuse our pallets instead of grinding them for mulch or pulp. In the first six months of the program alone, Powertrain recycled more than 120 tons of useful pallets.

To recognize all these efforts, Maryland's "Businesses for the Bay" presented the Hagerstown employees with its award for Outstanding Achievement for Pollution Prevention at a Large Facility.



## HAGERSTOWN POWERTRAIN TIMELINE

- 2007 Hagerstown assembles the new 13L heavy-duty engines for Mack and Volvo applications.
- 2007 Hagerstown begins grooming and electronic testing of Volvo "I-Shift" automated manual transmissions.



- 2007 Hagerstown's Product Development function launches Volvo's Operational Development program.
- 2007 Hagerstown assembles the final legacy (ASET) engine.
- 2007 Diesel particulate filters become standard equipment for North America to meet the stringent EPA '07 particulate regulation.
- 2008 Hagerstown begins production on the MP10 16L for Mack and on the Volvo D13 for Prevost, the newest customer for Powertrain in North America.
- 2008 Hagerstown deploys the Volvo Production System (VPS).



# “WE MAKE AN IMPACT”



Powertrain’s annual Bulldog® Round Up community open house, including the popular Bulldog Beauty contest, has helped eight local Lions Clubs to raise over \$100,000 for their various community charities.



The traditional annual parades in Hagerstown, MD and Mercersburg, PA provided inspiration for elaborate floats designed and built by Hagerstown employees, including this award-winning entry from 1996.

From the day Mack first decided to bring Powertrain to Hagerstown, our people and facility have had a significant and enduring impact on the city and the surrounding four-state region.

Plant expenditures on utilities and services; purchases from local suppliers; taxes paid to state and local governments: these are all mainstays of local economic health. We help to power growth of the local infrastructure to attract new business and new opportunities.

At the same time, Powertrain employees have contributed significantly to the local quality of life. Their time, money, expertise and leadership are the lifeblood of local and regional service groups, charitable agencies and civic organizations.

Through the cycles of feast and famine each generation has come to know, the people of Powertrain have always united together to make teamwork and service to others an ingrained part of our culture at Hagerstown.

## Youth Sports

From the arrival of Powertrain in Hagerstown, youth sports in the four-state area have had an active and enthusiastic supporter in our local UAW. Young athletes have found sponsorship for their little league sports, including basketball, soccer, baseball, and football, while individual employees frequently participate in team activities as coaches and event organizers.



## United Way

Both Powertrain and our UAW locals stand as major “corporate” sponsors of United Way in Washington County. A key project for senior management and union leaders every year, the annual campaign has collected more than \$6 million in employee and corporate contributions in Hagerstown. While some of our staff regularly take on roles as members of the county’s campaign board or as organizers of our United Way of Caring Day, other employees have given countless hours of their personal time, talents and energy.



## HAGERSTOWN POWERTRAIN TIMELINE



2008 - Hagerstown renames the entrance road to the facility “Volvo Way.”

- 2008** Hagerstown completes a major transformation in engine assembly and material flow improving ergonomics as well as increasing productivity and production capacity.
- 2009** Volvo Powertrain North America (VPT NA) is the first heavy-duty engine manufacturer to be certified by the EPA and CARB for the Selective Catalytic Reduction (SCR) technology to meet EPA 2010 regulations.
- 2009** Hagerstown deploys the Operational Development program to additional teams in the facility.

### 2010s

- 2010** VPT NA is first to deliver EPA2010-certified engines to customers.
- 2010** Hagerstown participates in the new Truly Global GeoFlex project, building 11L engines for Renault trucks.
- 2010** Hagerstown develops for Mack Trucks the CRD 150/151 rear axle carrier with faster ratios and optional differential locks.



**VOLVO**

Kiwans Cedar Ridge San Mar Local Fire & Rescue Companies Girl Scouts Marshall Street School Senior Centers  
 Toys For Tots Make-A-Wish Foundation of the mid Atlantic Mental Health Center HAGERSTOWN MODEL RAILROAD MUSEUM School Boards Exchange Club  
 Civitan Club Alzheimer's Association REACH American Red Cross Hagerstown Aviation Museum, Inc SPEBSQ School Bulldog Federal Credit Union  
 Union Rescue Mission Big Brothers / Big Sisters Mack Golden Bulldogs Renfrew Institute for Cultural and Environmental Studies Crohn's and Colitis Foundation  
 American Legion Ruritan Clubs Boy Scouts of America Washington County Rural Heritage Museum  
 Meals on Wheels CROP Community Free Clinic Fraternal Organizations Civil Air Patrol Walnut Street Community Health Center  
 Children's Village of Washington County, Inc Horizon Goodwill Industries Children In Need Maryland Symphony Orchestra

Washington County Free Library

Star Community THE ARC OF WASHINGTON COUNTY YFW  
 Hospice Community Mediation Center School of Associated Organizations  
 School Athletics Toastmasters Walnut Street Community Health Center YMCA Tri-State Area Hospitals  
 Interfaith Service Coalition Friends of Safe Place  
 American Cancer Society Salvation Army Hagerstown Junior Basketball League  
 AMVET Discovery Station at Hagerstown, Inc  
 Lions & Lionesses Clubs DEAFNET ASSOCIATION, INC Local Governments Boroughs & County Involvement  
 UNITED WAY Wells House Food Resources / Food Banks Rotary Clubs EASTER SEALS HABITAT FOR HUMANITY  
 Memorial Recreation Center

### Salvation Army



At Christmas time and year-round, volunteer workers from Powertrain help the Salvation Army bring aid to those in need throughout our area, "Ringing the Bells" for the Christmas donations, assisting the "Christmas Angels" and toy collection program or giving time to wrap gifts. Donations of surplus office equipment have also supported the local Thrift Store.



### Red Cross



With donations of "the gift of life," Powertrain employees have contributed more than 23,400 pints of blood, nearly 3000 gallons – potentially enough to save as many as 70,000 lives. Here pictured, over 20 years ago, are two long-time Hagerstown employees each donating their 19<sup>th</sup> gallon of blood.



The Red Cross also relies on our support for its disaster relief efforts.

### Boy Scouts



Powertrain provided land, design, and engineering assistance to construct the Mason Dixon Council's office building and also contributed manpower, materials plus excess kitchen equipment to improve the Council's Scout Camp. Every four years, when the Boy Scouts of America holds its National Jamboree, we provide the trucks and drivers to transport all their gear to and from site.



### Bulldog Federal Credit Union



Bulldog Federal Credit Union was among the nation's first credit unions, organized in 1968 by a group of UAW Local 171 employees. Bulldog Federal now serves more than 23,000 members, with seven full-service locations and has assets valued at more than \$114 million.



### Continuing Education

#### HCC Truck Driving School

Since 1995, Volvo Powertrain has provided the "West Lot" to Hagerstown Community College and its fleet as its truck driving training campus. The College has built 3 buildings for classrooms and offices. Over 1,500 have completed the course, with many now employed by local companies.



#### Our engines go to school

In 1966, Powertrain donated a pair of engines, one 6-cylinder and one V8, to Washington County Vocational & Technical School. Our practice of contributing engines and transmissions for automotive education continues today to area schools, technical institutions, and colleges in the four-state area.



### Fire Brigade and MERT

The volunteer fire brigade was among the first community ventures by Powertrain employees, beginning in 1962. Since then, employees have volunteered more than a quarter million hours to assist regional emergency services. More recently, members formed a Medical Emergency Response Team ("MERT") and are trained in special training as first responders and advanced life support.



## HAGERSTOWN POWERTRAIN TIMELINE

- 2010** Hagerstown begins grooming and electronic testing of Mack Truck's mDrive™ automated manual transmissions.
- 2010** July 15: Hagerstown builds the 300,000<sup>th</sup> Volvo D13 engine. Total production was shared between Volvo Powertrain in Hagerstown and Skovde, Sweden.



- 2010** Hagerstown recognized as one of the top 20 Best Practice tours in the region by AME's International Lean Conference.
- 2010** VPT NA is voted "Best Place to Work" in the area in a contest sponsored by The Herald-Mail, a local newspaper.
- 2011** Hagerstown extends the Operational Development program to engage and involve all employees in the Hagerstown facility.
- 2011** Hagerstown celebrates 50 years of developing and manufacturing powertrains.



# BUILDING FOR THE GENERATIONS

Offering steady jobs in highly skilled trades, Powertrain has always been able to attract people who take great pride in their work and pass that pride on to their families. As a result, many of the people working in the Hagerstown facility today are carrying on a family tradition that has been passed down generation to generation.

One such family -- the Eichelbergers -- has amassed a total of 136 years of service at Powertrain, and still counting. Other family histories go back to the 1920s, when it was known as the International Motor Company.

The Eichelberger dynasty began with Gene in April 1962, shortly after the plant opened. Three brothers soon followed in his footsteps with Joe in August 1962, Buck in May 1963, and Eldon in June 1968. Through all these years, the passion and commitment of the four brothers has spoken louder than any words could. When Buck's life was lost in a car accident in 1990, the family knew to commemorate his pride of workmanship by having the Mack Bulldog etched into his headstone. His widow, Dixie will still tell you, "Mack Trucks was number one in Buck's life."

The Eichelberger legacy at Powertrain has now passed on to Eldon's daughter Mandi and Gene's son Darrin.

"We were brought up to respect our employer and do the best you can every day. We take pride in the company and the products they make."

Rod Saloom  
8/9/1976



The memory of Donald "Buck" Eichelberger is shared here by his family at Powertrain: (L-R) brother Eldon, niece Mandi, nephew Darrin, brothers Gene and Joe and Buck's widow, Dixie.



"IN MY DAY IT WAS LIKE FAMILY; GENERATIONS OF PEOPLE. WE HAD SENSE OF BROTHERS WORKING TOGETHER THERE, FATHERS AND SONS; YOU END UP WITH MORE OF A FAMILY OPERATION ALL OVER."

MARK EBERLY  
1/12/1966 - 7/1/2005

# Tomorrow's Powertrain

Leading the heavy-duty engine industry to the world's strictest emissions standards in 2010, Powertrain is now poised to lead the world to new heights in engine power, torque and durability.

A wide array of technologies developed in Hagerstown and proven worldwide now come together in powerful customer solutions for truck and coach applications.

Hagerstown's heritage of integrated drive systems to maximize productivity and efficiency is driving the path to profitability for the next generation of operators.



## Volvo Engines

Today's Volvo engines from Powertrain build on the same proven engineering that customers have relied on for years, delivering the best fuel economy of any heavy-duty diesel engine in the industry.

Volvo reliability and efficiency are powering operational savings right to the bottom line for our customers.



## From Two Pollutants To Near Zero

With millions of miles of road experience worldwide, the SCR (Selective Catalytic Reduction) system utilized on Powertrain engines is the proven first step toward NOx-free, particulate-free emissions. Our SCR solution is layered with a DEF (Diesel Exhaust Fluid) to eradicate NOx and a DPF system to trap particulates without requiring active regeneration. The result is seamless emissions control that's healthier for people and simpler for trucks.

## A Shift In Intelligence

Whether our customer's goal is smooth, efficient long hauls, reliable stop & go performance or everyday productivity on tough off-road jobs, Mack and Volvo transmissions build on our generations of integrated powertrain experience to deliver the right solution.

Today's Maxitorque ES T300 still stands alone with its long-lasting triple countershaft design, multispeed reverse and choice of PTO mountings.

Our latest models of 2-pedal automated manual transmissions (AMTs) integrate seamlessly with their corresponding engines. With advanced electronic controls, it makes the driver more comfortable, more alert and safer. With feature packages tailored to varied tasks, I-Shift and mDRIVE transmissions are the ideal solution for applications from line haul, pickup & delivery, refuse and distribution to heavy haul and heavy construction.



## MP Series Engines

Our new MP engines live up to the reputation for dependability that Mack trucks have delivered on for more than a century.

The MP8 engine has the highest horsepower with the lowest emissions ever produced by Powertrain.



## Heavy-Duty Support

Developed in Hagerstown, trusted everywhere, our CRD 150/151 axle carriers feature a dual-reduction top-loaded design that produces the industry's quietest, vibration-free driveline. The unique spiral-bevel gear tooth first patented here more than 30 years ago, still ensures minimal friction loss and longer life in the most demanding applications.





# Truly Global

- WE ADD VALUE TO THE VOLVO GROUP
- WE BENEFIT FROM OUR GLOBAL RESOURCES
- WE MANAGE OUR PLATFORMS
- WE MASTER OUR CORE COMPETENCIES



## THE VOLVO WAY

We acknowledge and thank the many employees and retirees who shared their memories and time in the development of this commemorative booklet.

# OUR CULTURE IS OUR COMPETITIVE EDGE

Thanks to our Mack colleagues for assisting in the funding towards this booklet.

