Influential Cars of the 20th Century VII

Jim Rauf

Braking System Improvements

- Mechanically actuated drum brakes were superseded by hydraulically actuated drum brakes
- The first self adjusting drum brakes were on the 1925 **Cole** - in its last year of production
- 1946 **Studebaker** featured self adjusting brakes using a **Wagner Electric Co**. mechanism
- 1962 unibody **RAMBLER AMERICAN DELUXE** introduced the dual master brake cylinder for its hydraulic brakes and were applied to its entire fleet in 1964


1925 **Cole**


1962 Rambler American Deluxe


1946 Studebaker

Brakes

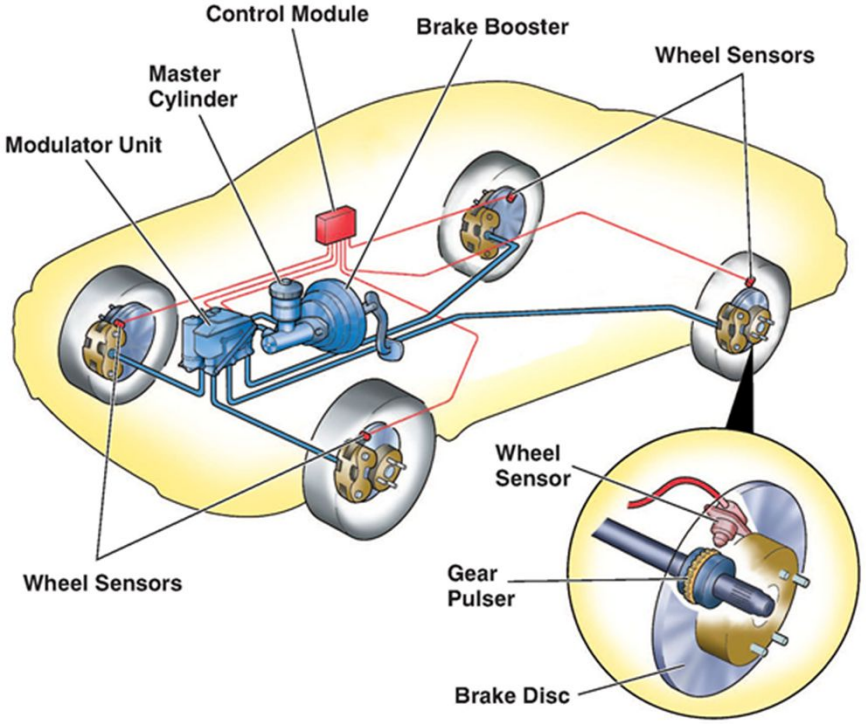
- Front wheel **disk brakes** appeared on production cars with the 1962 **Studebaker Avanti** and were standard on all **Studebakers** in 1964
- Anti lock braking systems (ABS) came later and were used in the **Jensen FF** sports sedan in 1966
- The initial form of **ABS** as we know it today was introduced on a **W116 Mercedes-Benz S-Class** in 1978
- It became the first ‘four-wheel multi-channel anti-lock brake system’
- The system was developed by **Bosch** and **Daimler**
- **ABS** prevents the wheels from locking up under heavy baking
- **ABS** allows the front wheels to continue steering the car in a turn under heavy braking



- **ABS** allows the front wheels to continue steering the car in a turn under heavy braking

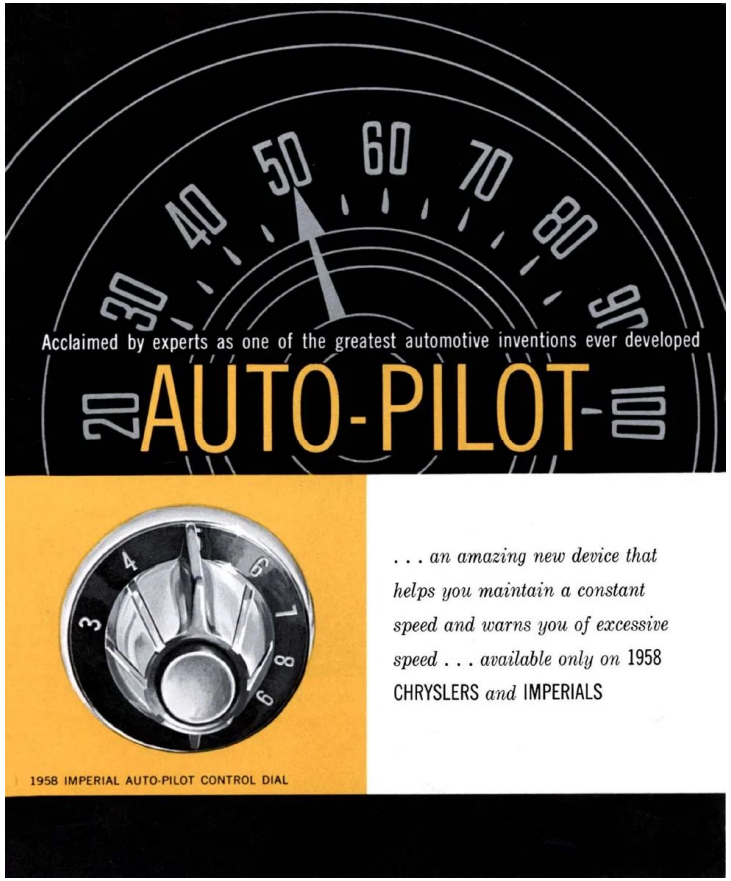
Anti Lock Brakes

- The anti-lock braking system uses a **computer** to monitor the change in rotational speed of each wheel during braking
- If the speed slows too quickly (such as when braking on a slippery surface) and the wheel risks locking, the computer automatically reduces the brake pressure
- The wheel accelerates again and the brake pressure is increased again, thereby braking the wheel
- This process is repeated several times in a matter of seconds



Cruise Control

- **Chrysler Imperial** introduced first car with cruise control systems in 1958

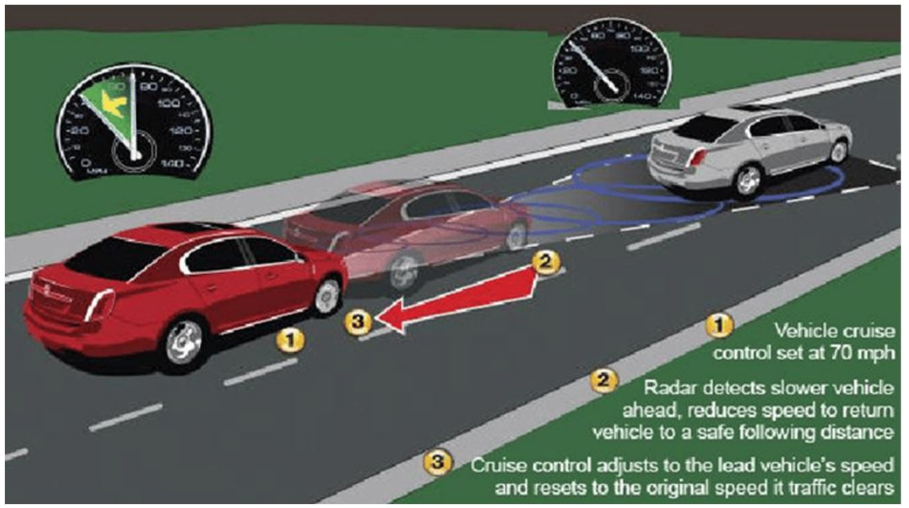




Adaptive Cruise Control (ACC)

- 1998, **Toyota** became the first to introduce an **adaptive cruise control** (ACC) system on a production vehicle - a laser-based system for its **Progress** compact luxury sedan, which it sold in Japan
- **Nissan** followed suit with a radar-based system, in the company's **Cima 41LV-2**, a luxury sedan also sold only in Japan
- 1999 **Jaguar** began offering an **ACC** for its **XKR** coupes and convertibles sold in Germany and Britain





Pontiac GTO and the Muscle Cars

- 1964 **Pontiac GTO** –the first “muscle car”
- The **GTO** package was an option package on the **Pontiac Lemans** with a 389 cid 325 hp V8 (4 bbl carb)
  - A Three carb 348 hp engine was an additional option
- All the U.S. manufacturers followed suit with their versions of the *Big Engine Small Car*
- Performance cars were popular especially with younger buyers

1964-1969 Pontiac GTO 389
1966-1971 Plymouth/Dodge A-body 426 models
1966-1967 Chevy Nova SS 327
1966-1969 Chevy Chevelle SS 396
1968-1969 Chevy Nova SS 396
1969 Ford Torino Cobra 428
1969 Plymouth Road Runner 440 Six Pack
1969 Dodge Super Bee 440 Six Pack
1969 Chevrolet Camaro COPO ZL-1
1970 Chevy Chevelle SS 454



Muscle car popularity declined through the early 1970s, due to factors including the **Clean Air Act**, the **fuel crisis** and especially increasing **insurance costs**

Oldsmobile Tornado - Front Wheel Drive

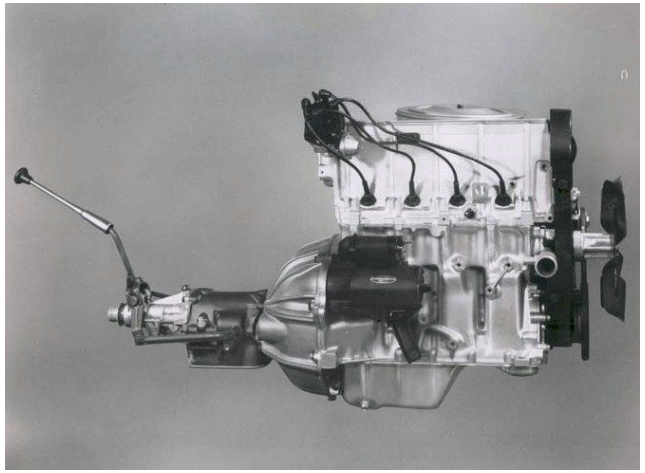
- The 1966 **Oldsmobile Tornado** was first U.S built front wheel drive (FWD) ar since the Demise of the **Cords** in 1937
  - The **Cord L-29** (1929-1931) was the first "practical" U.S built FWD car
- The Toronado used a transaxle version of **GM**'s **Turbo-Hydramatic** transmission
- It used a **Rochester Quadrajet** four-barrel carburetor on its 425 cid 385 hp V8 engine
- "**Draft-Free**" ventilation system, that eliminated conventional front-door triangular window vents
  - All manufacturers followed suit in eliminating the front window vents





1970 Chevrolet Vega - Linerless Aluminum Engine Blocks





- **1970 Chevrolet Vega** used a cast aluminum engine block without cast iron cylinder liners
- Prior aluminum block engines used cast iron cylinder liners or sleeves
- The block used an aluminum alloy developed by **Reynolds Aluminum** that had silicon to provide strength to the cylinder walls
- The overhead camshaft engine used a cast iron cylinder head
  - The **Vega** engine was not a successful engine
- **Ford's Pinto** used conventional cast iron engine blocks



Air Bags 1973

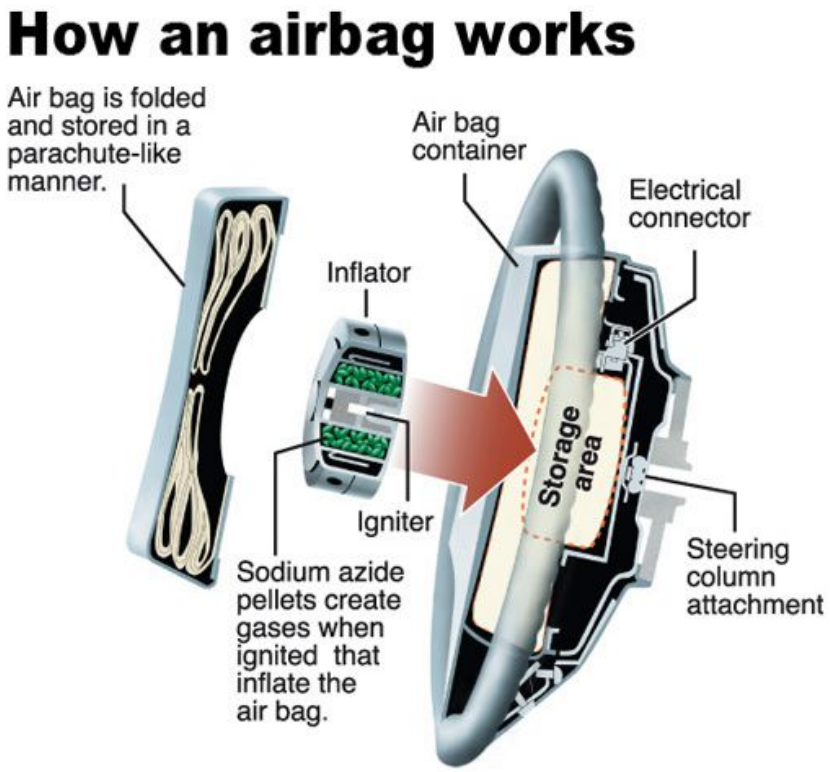
- A number of patents for airbag systems date back to the 1950s
- **Walter Linderer's** 1951 patent was based on a compressed air system, either released by bumper contact or by the driver
- **John Hetrick's** 1953 patent for his "*safety cushion assembly for automotive vehicles*," was also based on compressed air
- Research during the 1960s proved that compressed air was not capable of inflating the airbags quickly enough to be effective
- **Allen Breed** invented a "sensor and safety system" in 1968 that was the world's first electromechanical automotive airbag system
- In 1964, Japanese automobile engineer **Yasuzaburou Kobori** was developing an airbag "safety net" system that employed an explosive device to trigger airbag inflation
    - He was awarded patents in 14 countries

- In 1971, the **Ford Motor Company** built an experimental airbag fleet
- **General Motors** installed airbags in a fleet of **1973 Chevrolet Impalas**—for government use only
- The **1973 Oldsmobile Toronado** was the first car with a passenger airbag sold to the public



- Airbags have been mandatory in all new cars sold in the U.S. since 1998

Air Bags 1973





Catalytic Converter

- **GM** announced that all its 1971 car engines would be changed to run on low octane, **nonleaded fuel**
- This entailed using lower compression ratio engines-resulting reduced power and gas milaege
- This was in anticipation of going to **catalytic converters** rather than more complex emission control devices in 1975 to control emissions
    - Catalytic converters were “poisoned” by leaded gasoline
- Also a response to studies showing urban area high human concentrations of lead
- **Ford** and **Chrysler** followed suit
- To comply with the **U.S. Environmental Protection Agency 's** stricter regulation of exhaust emissions, most gasoline-powered vehicles starting with the 1975 model year are equipped with catalytic converters

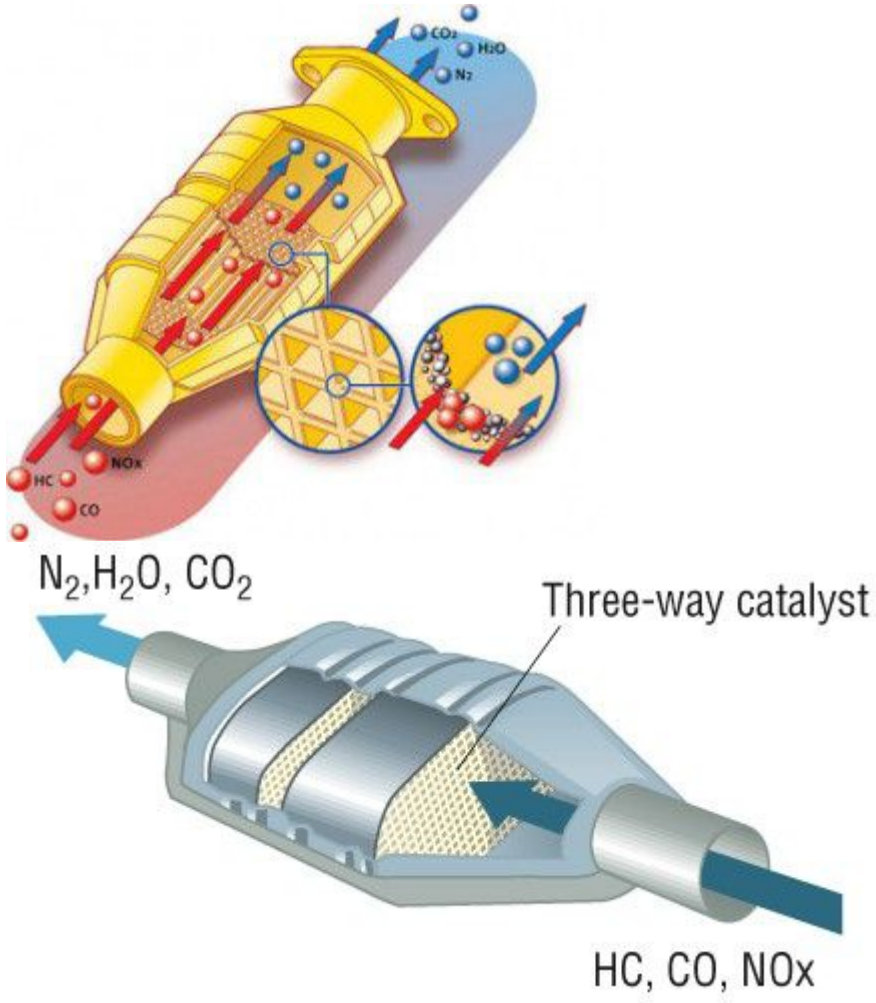


Catalytic Converter

- Most cars use “three-way catalytic converters”
- The reduction catalyst uses platinum and rhodium to help reduce the **NOx** emissions
- When an NO or NO2 molecule contacts the catalyst, the catalyst strips the nitrogen atom out of the molecule and holds on to it, freeing the oxygen in the form of O2
- The nitrogen atoms bond with other nitrogen atoms that are also stuck to the catalyst, forming N2

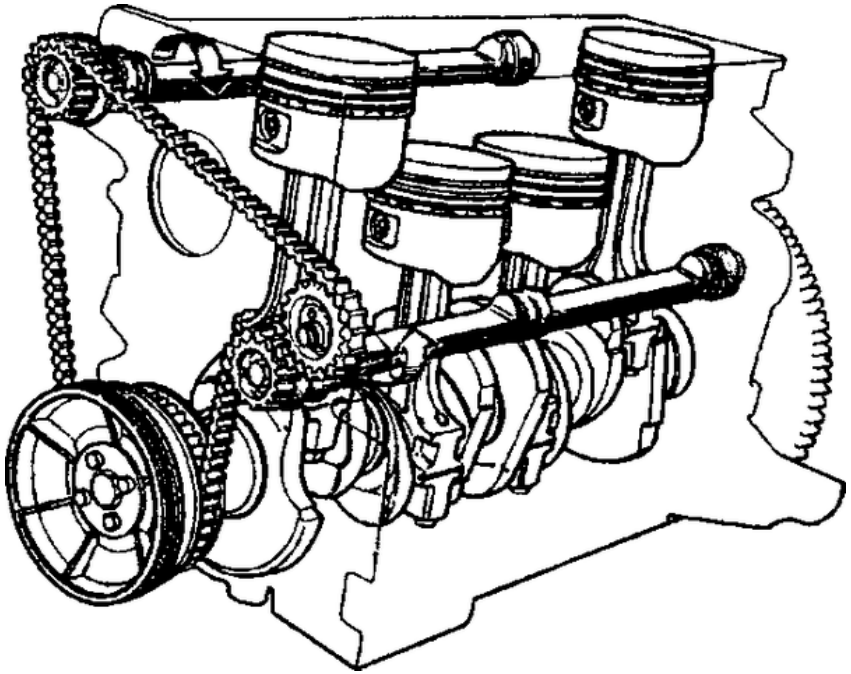
  2NO => N2 + O2 or 2NO2 => N2 + 2O2
- The oxidation catalyst reduces the **unburned hydrocarbons** and **carbon monoxide** by burning (oxidizing) them over a platinum and palladium catalyst
- This catalyst aids the reaction of the CO and hydrocarbons with the remaining oxygen in the exhaust gas

  2CO + O2 => 2CO2



Mitsubishi Engine Balance Shafts 1975

- Inline four cylinder engines have an inherent second order vibration (vibrating at twice the engine RPM) which cannot be eliminated no matter how well the internal components are balanced
- Two balancing shafts can be used to balance out the vibrations
- **Mitsubishi Motors** pioneered the design in the modern era with its "**Silent Shaft**" Astron engines in 1975, with balance shafts located low on the side of the engine block and driven by chains from the oil pump
- The patent was subsequently licensed by **Fiat, Saab** and **Porsche**



Balance shafts allow inline 4 cylinder engines larger than about 2.0 liters to operate smoothly

GM X Cars - 1980 FWD Compacts

- **GM** introduced its compact FWD "**X cars"** in 1980
  - FWD cars became more common through imports and U.S. badged "captive" imports
- **GM's** X-bodies were the first all-American developed front-wheel drive cars introduced for high-volume, mainstream sales
  - As alternatives to imported front-wheel drive compacts
- 1978 **Chrysler** had introduced the first U.S -built transverse-engine cars, the **Plymouth Horizon** and **Dodge Omni** (designed by **Chrysler of Europe**)
- They featured transverse engines and transmissions
  - Features first made common on the **Austin Minis**
- All **GM** brands except **Cadillac** models were offered

  Chevrolet Citation

  Pontiac Phoenix

  Oldsmobile Omega

  Buick Skylark


Chevy Citation


Buick Skylark



Plymouth Horizon

GM - 1980 FWD Cars

- **GM's X Cars** were the first of their mass market front wheel drive (FWD)cars
- **GM** followed with the **J body** small FWD cars in the 1980's
  - Chevrolet Cavalier
  - Pontiac J2000
  - Oldsmobile Firenza
  - Buick Skyhawk
  - Cadillac Cimarron
- And **A** body mid size FWD cars in the 1980's as well
  - Chevrolet Celebrity
  - Pontiac 6000
  - Oldsmobile Cutlass Ciera
  - Buick Century

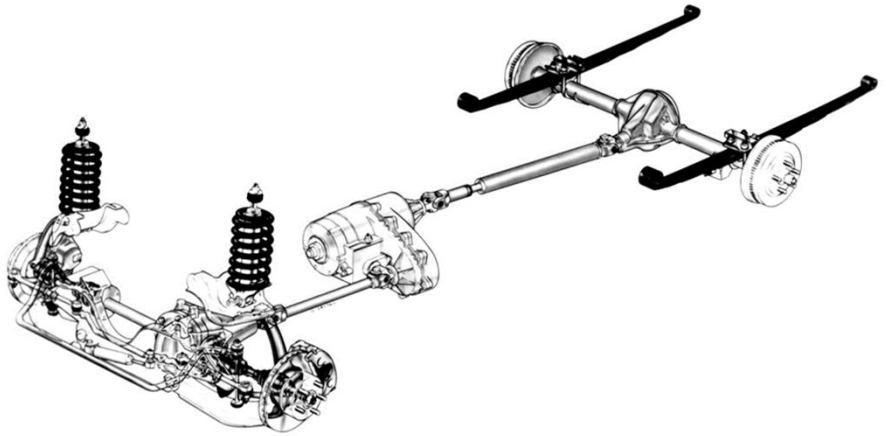




Crossover 1980 AMC Eagle

- The first modern-day **crossover SUV** was the **American Motors Corporation**, **Eagle**
- **AMC** decided to mate the 4-wheel-drive system from **Jeep** with their unit-body passenger cars The Eagle had an independent front suspension
- It also had higher ground clearance than the cars
- The **Eagle** originally had a full-time 4-wheel-drive system
- In 1981, **AMC** added an optional part-time system called "**Select Drive**," which disconnected the front driveshaft in order to save fuel
- The **Eagle** was offered as a 2-door coupe, a 4-door sedan and a 5-door wagon





1980 First Variable Valve Timing

- The **1980 Alfa Romeo Spider 2.0** was the production car to use a variable valve timing (VVT)
- It had a *mechanical* VVT system in SPICA fuel injected cars sold in the United States
- Later this was also used in other cars
- The system was engineered by Ing **Giampaolo Garcea** in the 1970s



- The **Honda VTEC** engine introduced in the late 1980s was the first production engine with *computer-controlled valve timing*

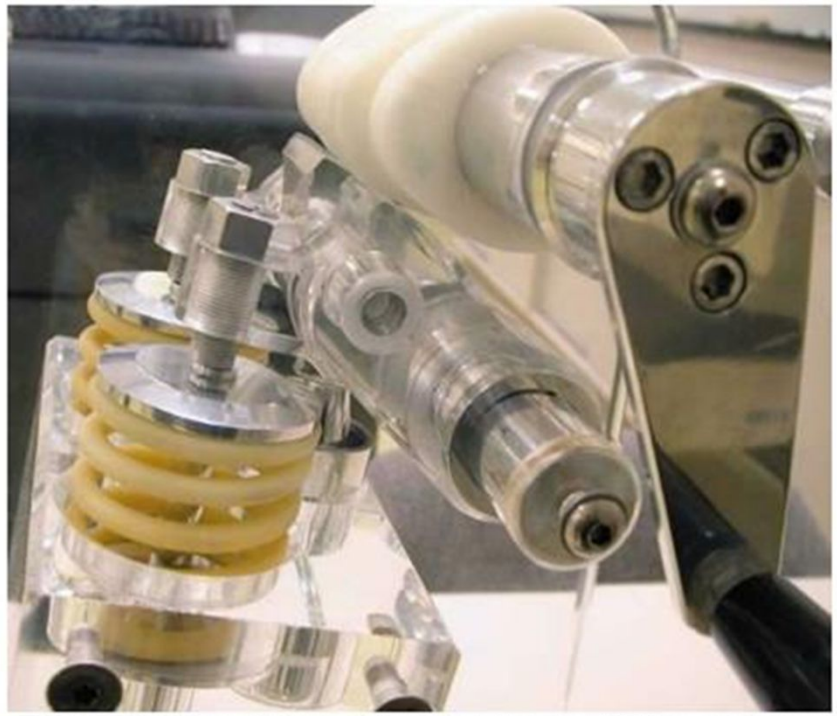


FIGURE 11–10 A plastic mock-up of a Honda VTEC system that uses two different camshaft profiles; one for low-speed engine operation and the other for high speed.

1980 First Variable Valve Timing

- Without variable valve timing or variable valve lift, the valve timing remains the same for all conditions; thus, compromises are necessary from a cam-profile perspective
- An engine equipped with variable valve timing isn't constrained by a set profile, allowing performance to be improved over a broader operating range
- By coming up with a way to alter valve timing between high and low rpms, manufacturers now can tune valve operation for optimum performance and efficiency throughout the entire rpm range
- The camshaft's timing is advanced to produce better low-end torque, or it can be retarded to have better high-end torque as the conditions arise
- Electronic engine controls allow today's VVT systems to significantly increase low- and high-speed engine torque and fuel economy and reduce tailpipe emissions. However, VVT has caused some issues concerning engine lubrication and diagnostics.

BMW-VANOS (Variable Nockenwellen Steuerung)
Ford-VVT (Variable Valve Timing)
GM-DCVCP–(Double Continuous Variable Cam Phasing) if used for both intake and exhaust camshafts
Honda-VTEC - Variable valve Timing and lift Electronic Control
Hyundai-MPI CVVT (Multiport Injection Continuously Variable Valve Timing)
Mazda-S-VT (Sequential Valve Timing)
Mitsubishi-MIVECC (Mitsubishi Innovative Valve timing Electronic Control system)

Nissan-N-VCTT (Nissan Variable Control Timing)
Nissan-VVL (Variable Valve Lift)
Porsche-variocam–(Variable camshaft timing)
Suzuki-VVT (Variable Valve Timing)
Subaru-AVCS (Active Valve Control System)
Toyota-VVT-i (Variable Valve Timing-intelligent)
Toyota-VVTL-I (Variable Valve Timing and Lift-intelligent)
Volkswagen-VVT (Variable Valve Timing)
Volvo-VVT (Variable Valve Timing)

1978 GM V8 Diesel Engine

- 1978 **Oldsmobile** introduced its 350 cu in V8 diesel engine
- High fuel mileage in a big car
- The engines had serious reliability issues
- The engines used strengthened engine blocks but they used the head bolt design and pattern from the 350 cid gasoline engine
- Head bolt failures resulted , as the engines had compression ratios of 22.5:1 , almost 3 times that of the comparable gasoline V8 engines
- **GM** fixed most of the engines' issues but the diesel V8 damaged **GM's** reputation

jR2



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jR2 james Rauf, 6/9/2021

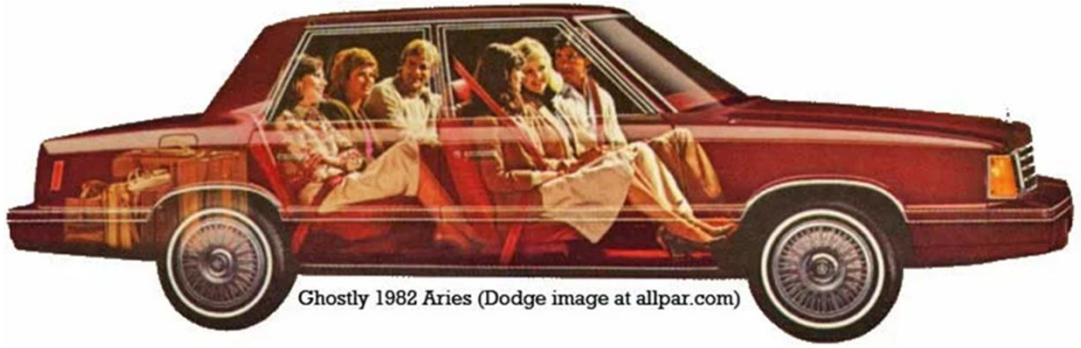
1981 Cylinder Deactivation

- 1981 Cadillac introduced a system to change its 368-cubic-inch V8 engine to a more economical V6 or V4 engine by “shutting down” two four cylinders when they were not needed
- This was determined by **Cadillac's** on-board **Computer Command Module,** which used sensors to monitor engine speed, EGR, idle speed, intake manifold air pressure, coolant temp, air pump operation and exhaust, and adjusted the throttle body fuel injection air-fuel mixture accordingly
- The V8-6-4 system worked via solenoid activated blocker plate that moved the rocker arms on two or four of the engine's cylinders,
- It never worked so well in the real world
- The system was dropped after one year



Chrysler K Cars

- The **Chrysler K-Car** platform was introduced for the 1981 model year
- It featured a transverse engine, front-wheel drive, independent front and semi-independent rear suspension
- It was derived from the **Plymouth Horizon** and **Dodge Omni**
- The platform at first underpinning a modest range of compact/mid-size sedans and wagons
- Eventually underpinning nearly fifty different models, including all-wheel drive variants
- It played a vital role in **Chrysler's** subsequent resurgence





Chrysler K Cars

(inches unless noted; 1986 figures)	Two-door	Four-door	Wagon
Wheelbase	100.3	100.3	100.4
Length	178.6	178.6	179
Width	68	68	68
Height	52.5	52.9	53.2
Track (max)	57.6	57.6	57.6
Turning diameter	35.2'	35.2'	35.2'
Headroom, F/R	38.2 / 37.0	38.6 / 37.8	38.6 / 38.5
Legroom, F/R	42.2 / 35.1	42.2 / 35.4	42.2 / 34.8
Hiproom, F/R	55.7 / 54.3	55.6 / 56.2	55.6 / 56.2
Trunk capacity, cubic feet	15	15	34.9
Cargo, second seat down, c.f.			67.7
Gas tank (gallons)			13



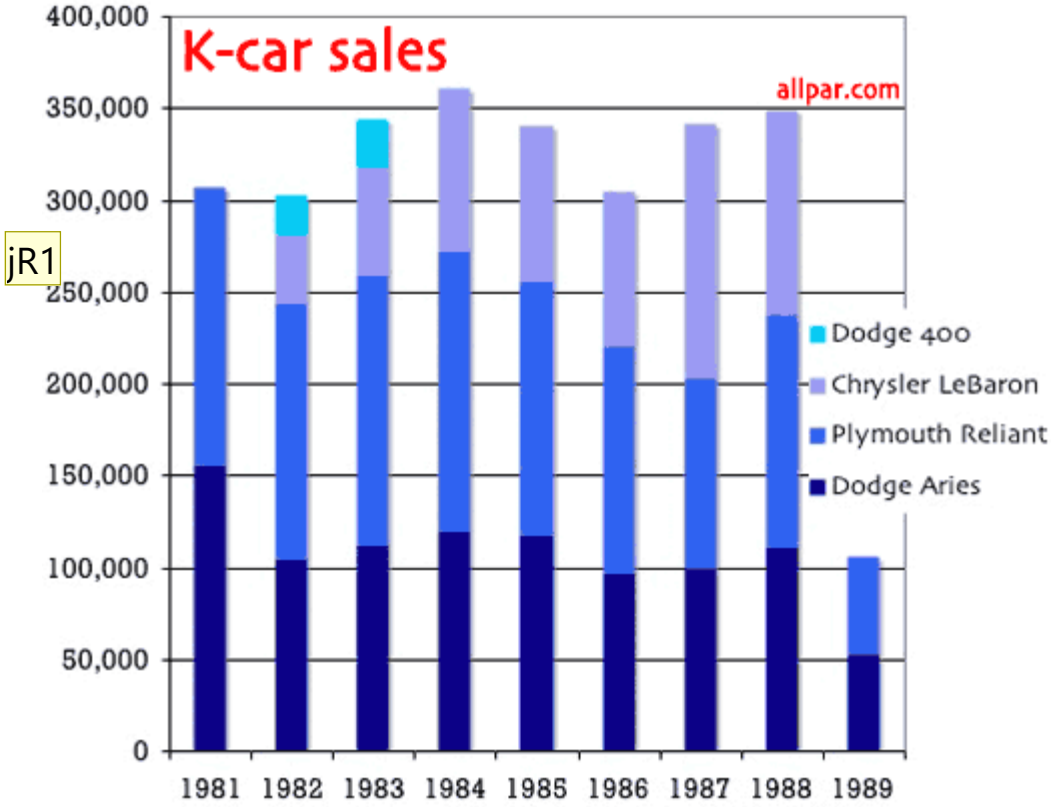




Chrysler K Cars

- K Car platform cars
  - Dodge Aires
  - Dodge 600
  - Dodge 400
  - Plymouth Reliant
  - Plymouth Caravelle
  - Chrysler LeBaron
  - Chrysler E Class
  - Chrysler Executive
  - Chrysler New Yorker

- The K Car platform provided the basis for Chrysler's mini vans



jR1

Slide 24

jR1 james Rauf, 4/21/2021

Chrysler Mini Vans

- The **Chrysler minivans** were introduced for the 1984 model year
- Initially introduced as the **Dodge Caravan** and **Plymouth Voyager**
- The **Chrysler** minivans are the highest-selling example of the segment
  - A total of 15 million reached by 2019
- The **Chrysler** minivans launched the mini van segment in the U.S. and Canada
- **GM, Ford, Toyota, Mazda, Honda, Nissan, Kia** all manufactured mini vans



Chrysler Mini Vans

- By some accounts, the 1950 **Volkswagen Microbus** was the original minivan
- But it was **Chrysler's** mini vans introduced in 1984 that really popularized the mini van and created the segm
- It was the right vehicle for the times in 1984





- The **Chrysler** mini vans were more "practical" than the **VW Microbus**
- They were more 'car Like"

Influential Cars of the 20th Century—Next session

- Automotive electronic controls of various engine functions
- Diagnostic systems
- Introduction of the first modern electric car
- Electronic fuel injection systems
- Introduction of the first hybrid electric cars
- Collision avoidance systems