# Safe Harbor

In the presentation that follows and in related comments by General Motors management, our use of the words “expect,” “anticipate,” ”project, “ “estimate,” “forecast,” “objective,” “plan,” “goal” and similar expressions is intended to identify forward looking statements.

While these statements represent our current judgment on what the future may hold, and we believe these judgments are reasonable, actual results may differ materially due to numerous important factors that are described in GM’s most recent report on SEC Form 10-K which may be revised or supplemented in subsequent reports on SEC Forms 10-Q and 8-K. Such factors include, among others, the following: changes in economic conditions, currency exchange rates or political stability; shortages of fuel, labor strikes or work stoppages; market acceptance of the corporation's new products; significant changes in the competitive environment; changes in laws, regulations and tax rates; and, the ability of the corporation to achieve reductions in cost and employment levels to realize production efficiencies and implement capital expenditures at levels and times planned by management.

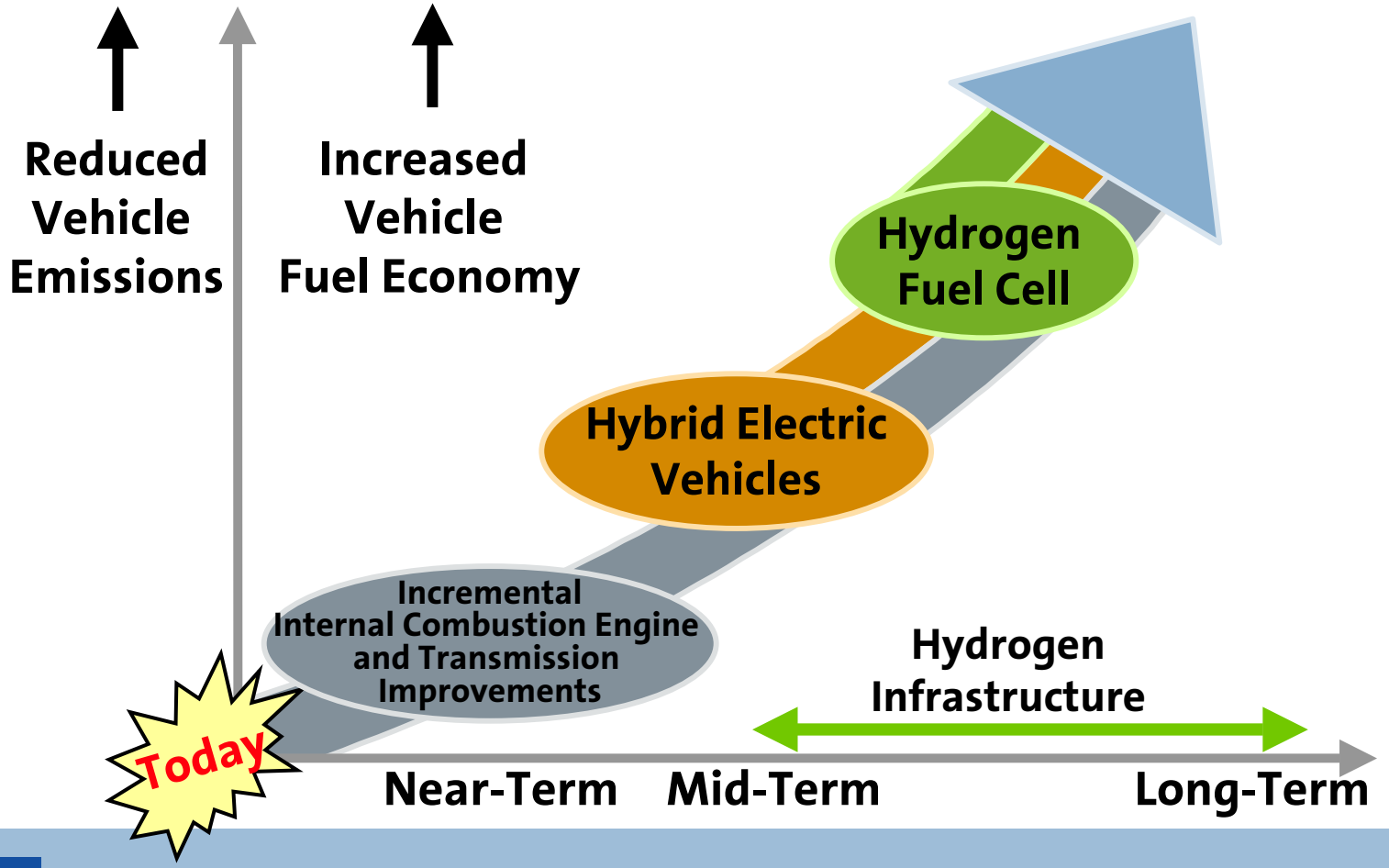
# Fuel Economy Technologies Media Briefing

*Presenter: Bob Kruse, Executive Director, Vehicle Integration*

*Date: June 29, 2004*

# GM Vehicle Engineering Center

# Advanced Technology and Sustainability
# GM Technology Strategy



# Agenda

- GM fuel economy leadership in high-volume vehicles
- Fuel saving technologies for mainstream vehicles
- Comparison of high-volume 2004 vehicles in key segments
- Case study: 2005 GM Full-Size Trucks
- Q&A

# GM Fuel Economy Leadership

- For mainstream vehicles that many Americans buy and drive, analysis of EPA numbers shows that GM is a fuel economy leader
  - Number one in many segments
  - Close to leader in other segments
- How we do it:
  - Result of decades of intelligent engineering and hard work by thousands of GM engineers
  - Result of many incremental, hard-earned improvements – no “silver bullets”
  - Result of work that continues today and every day

# GM has fuel economy leadership across more U.S. segments than any other manufacturer

Fuel economy ranking by Ward's segmentation

Note: Excludes hybrid, diesel, and alternative fuel vehicles

*EPA Ranking by Ward's Segmentation*

| Segment | City Leadership | City Mpg | Hwy Leadership | Hwy Mpg |
|---|---|---|---|---|
| ***Car*** | | | | |
| Lower Small | Toyota Echo | 35 | Toyota Echo | 43 |
| Upper Small | Honda Civic | 36 | Honda Civic | 44 |
| Small Speciality | Toyota Celica | 29 | Mini Cooper | 37 |
| Lower Middle | **Oldsmobile Alero, Pontiac Grand Am** | 26 | **Oldsmobile Alero Pontiac Grand Am** | 37 |
| Upper Middle | Honda Accord | 26 | Honda Accord | 34 |
| Middle Speciality | Acura RSX | 27 | Acura RSX | 34 |
| Large Regular | Chrysler Concorde, Dodge Intrepid, Toyota Avalon | 21 | Chrysler Concorde, **Buick LeSabre,** Nissan Maxima, **Pontiac Bonneville,** Dodge Intrepid, Toyota Avalon | 29 |
| Lower Luxury | **Saab 9-3,** Audi A4, Mercedes C-Class, Acura TSX | 23 | **Saab 9-3** | 33 |
| Middle Luxury | **Saab 9-5** | 21 | **Saab 9-5,** BMW 5 Series | 30 |
| Upper Luxury | Jaguar XJ, BMW 7 Series, Lexus LS 430, Mercedes S Class | 18 | Jaguar XJ | 28 |
| Luxury Speciality | Mercedes CLK | 20 | **Pontiac GTO** | 29 |
| Luxury Sport | Audi TT, Mercedes SLK | 22 | BMW Z4, Porsche Boxster, Mercedes SLK | 29 |
| ***Truck*** | | | | |
| Large Van | **GMC Savana,** Ford Econoline **Chevrolet Express** | 15 | **GMC Savana, Chevrolet Express** | 20 |
| Luxury Van | Chrysler Town & Country | 20 | Chrysler Town & Country, **Oldsmobile Silhouette** | 26 |
| Small Pickup | Ford Ranger, Mazda B Series | 24 | Ford Ranger, Mazda B Series | 29 |
| Large Pickup | **GMC Sierra,** Ford F Series **Chevy Silverado** | 17 | **Chevy Silverado,** Dodge Ram **GMC Sierra** | 21 |
| Middle Sport/Utility Vehicle | Jeep Liberty, Nissan Xterra | 19 | Jeep Liberty, Nissan Xterra | 24 |
| Middle Luxury Sport/Utility Vehicle | **Buick Rainier, Olds Bravada** | 16 | **Buick Rainier, Olds Bravada** | 21 |
| Large Sport/Utility Vehicle | **Chevy Tahoe, GMC Yukon,** Dodge Durango | 16 | Dodge Durango | 21 |
| Large Luxury Sport/Utility Vehicle | **Cadillac Escalade** | 14 | Lincoln Navigator, **Cadillac Escalade** | 18 |
| Small Van | Dodge Caravan | 20 | Toyota Sienna | 27 |
| Small Cross/Utility Vehicle | Toyota Rav4 | 24 | Toyota Rav4 | 30 |
| Middle Cross/Utility Vehicle | **Saturn Vue** | 24 | **Saturn Vue,** Honda CRV | 29 |
| Middle Luxury Cross/Utility Vehicle | Lexus RX 330 | 20 | Lexus RX 330 | 26 |
| Small sport/Utility Vehicle | **Chevy Tracker,** Suzuki Vitara | 19 | **Chevy Tracker,** Suzuki Vitara | 22 |

# Examples of Fuel-Saving Vehicle Technologies

- Vehicle mass reduction through design and premium materials
- Low-drag brake calipers
- Lower-rolling resistance tires
- LED brake lights
- High efficiency alternators
- Mechanical returnless fuel system with variable speed fuel pump

# Examples of Fuel-Saving Powertrain Technologies

- Mass reduction
  - Lightweight materials and composites
- Air exchange loss
  - Variable valve timing
- Friction/parasitic loss reduction
  - Roller lifters and roller rocker arms
  - Electric power steering (EPS)
- Thermal efficiency enhancements
  - Higher compression ratio
  - Enhanced spark control
- 5-speed automatic and 6-speed manual transmissions

# Integration of Technologies

- Technology benefits vary depending on application
  - Appropriate balance between fuel economy, performance, safety and other integration areas (e.g. noise, vibration)
- Not all technologies can be applied to all vehicles
  - Some vehicles have high payload and towing requirements which may limit technology applications
- Technologies are not necessarily additive
  - 1% fuel economy improvement plus 1% fuel economy improvement does not necessarily equal 2% fuel economy improvement

# Case Studies: Mainstream Vehicles

- Examples – mid-size cars, premium crossover SUVs, full-size pickups, full-size SUVs
- Mainstream vehicles that millions of motorists drive every day for work, personal use and family vacations
- Configured the way most customers buy them, i.e. automatic transmissions
- We encourage media and consumers to do their own side-by-side comparisons on the EPA site (www.fueleconomy.gov)

# Families on a Budget:
# Mid-Size Cars with I-4 and Automatic Trans

| Vehicle | Chevy Malibu | Toyota Camry | Honda Accord | Nissan Altima |
|---|---|---|---|---|
| Engine | 2.2L I-4 | 2.4L I-4 | 2.4L I-4 | 2.5L I-4 |
| Trans. | 4-sp. auto | 4-sp. auto | 5-sp. auto | 4-sp. auto |
| City MPG | 24 | 23 | 24 | 23 |
| Highway MPG | 34 | 32 | 34 | 29 |

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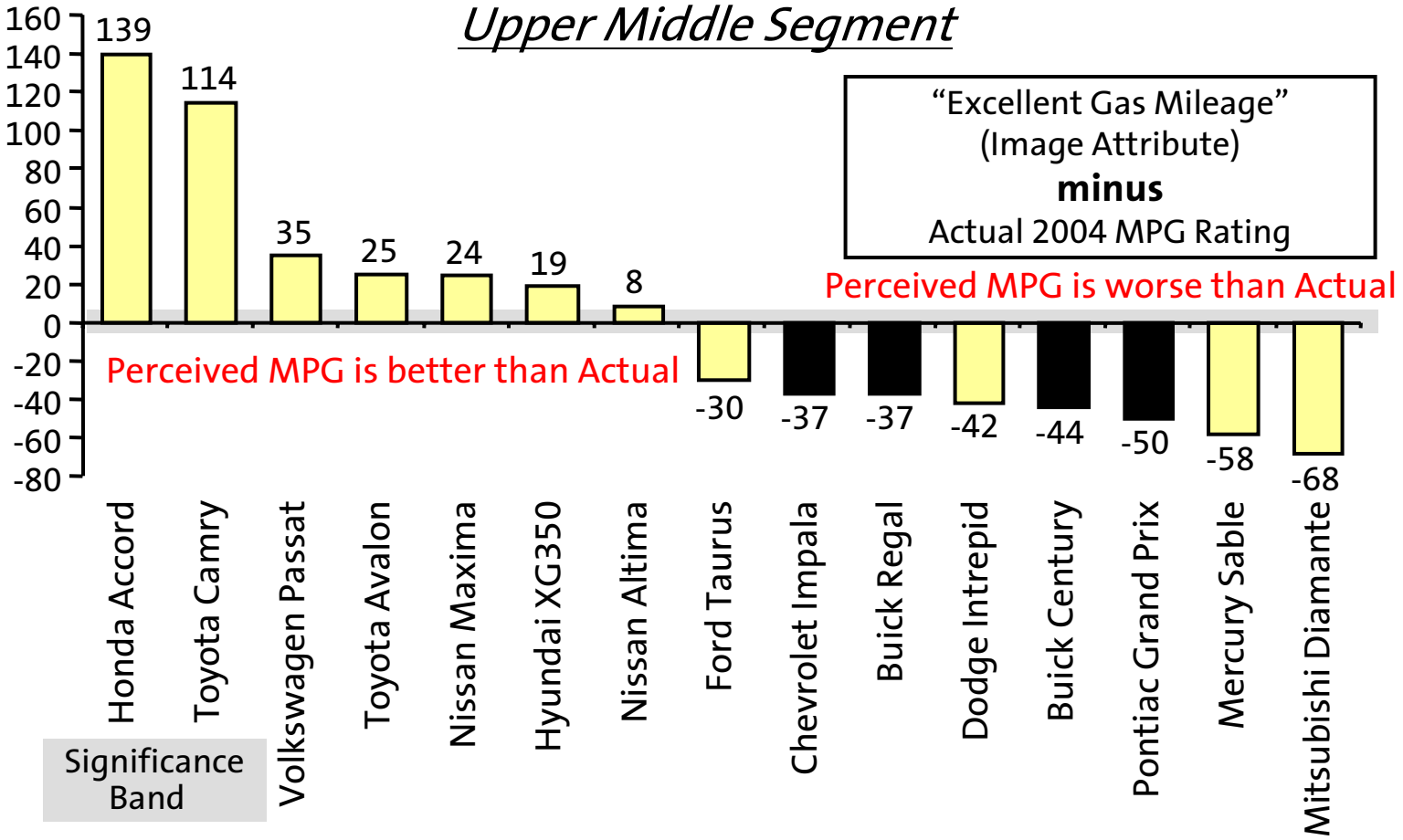
# Fuel Economy Perception versus Reality




*Source:*
*U.S. EPA 2004 Fuel Economy Guide, 2003; Allison-Fisher Barometer of Awareness & Imagery, December 2003*

# Faster Families:
# Mid-Size Cars with V-6 and Automatic Trans

| Vehicle | Chevy Malibu | Chevy Malibu Maxx* | Toyota Camry | Honda Accord | Nissan Altima |
|---|---|---|---|---|---|
| Engine | 3.5L V-6 | 3.5L V-6 | 3.0L V-6 | 3.0L V-6 | 3.5L V-6 |
| Trans. | 4-sp. auto | 4-sp. auto | 5-sp. auto | 5-sp. auto | 4-sp. auto |
| City MPG | 23 | 22 | 21 | 21 | 19 |
| Highway MPG | 32 | 30 | 29 | 30 | 26 |

* EPA rates Malibu Maxx as a Large sedan

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# SUVs with Class:
# Premium Crossover Utilities with 4WD

| Vehicle | Buick Rendezvous | Acura MDX | Lexus RS330 | Chrysler Pacifica |
|---|---|---|---|---|
| Engine | 3.4L V-6 | 3.5L V-6 (premium fuel) | 3.3L V-6 | 3.5L V-6 |
| Trans. | 4-sp. auto | 5-sp. auto | 5-sp. auto | 4-sp. auto |
| City MPG | 18 | 17 | 18 | 17 |
| Highway MPG | 24 | 23 | 24 | 22 |

# Family Haulers:
# Full-Size SUVs with Base V-8 and 2WD

| Vehicle | Chevy Tahoe 1500 | Ford Expedition | Nissan Pathfinder Armada | Toyota Sequoia | Dodge Durango |
|---|---|---|---|---|---|
| Engine | 4.8L V-8 | 4.6L V-8 | 5.6L V-8 | 4.7L V-8 | 4.7L V-8 |
| Trans. | 4-sp. auto | 4-sp. auto | 5-sp. auto | 4-sp. auto | 5-sp. auto |
| City MPG | 16 | 15 | 13 | 14 | 14 |
| Highway MPG | 19 | 19 | 19 | 18 | 19 |

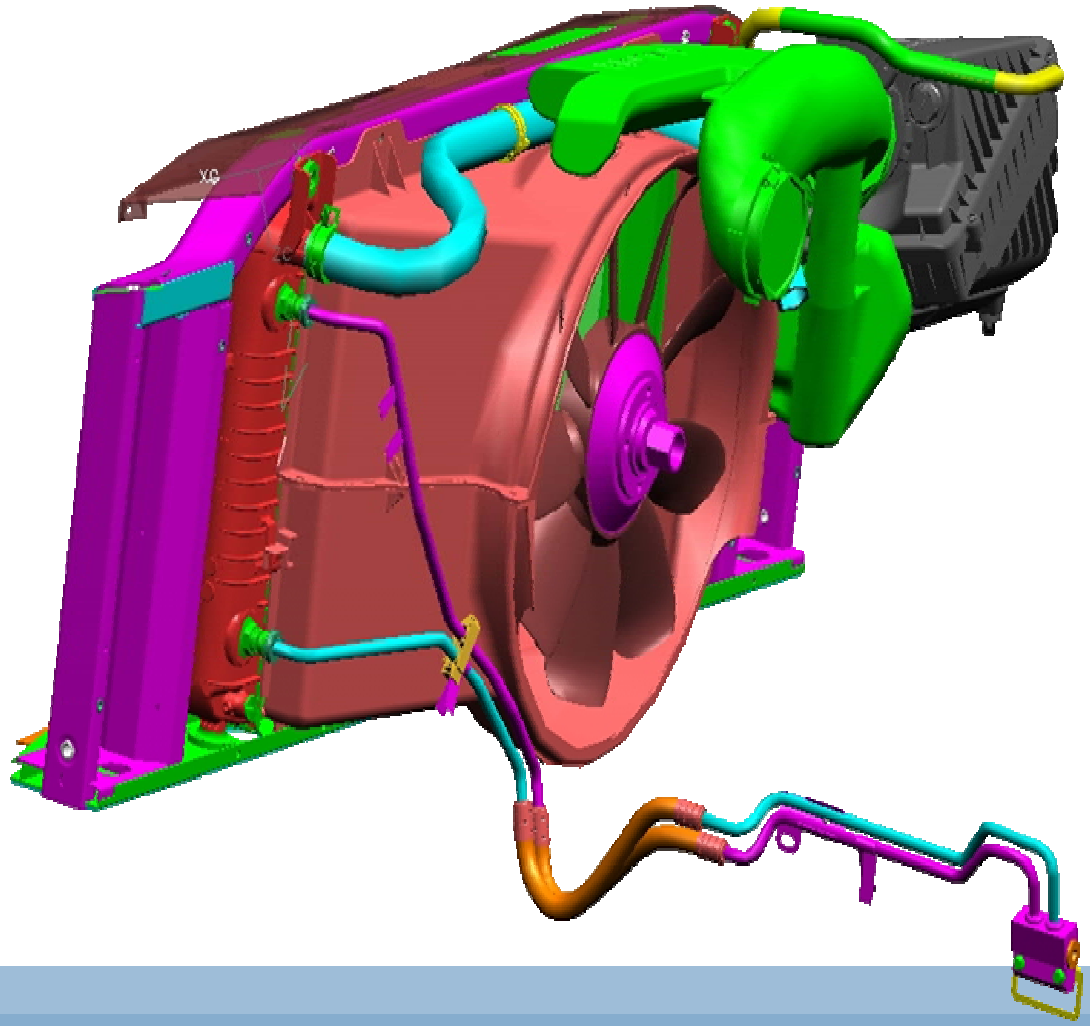
# America's Workhorse: Full-Size Pickups with Base V-8 and 2WD

| Vehicle | Chevy Silverado 1500 | Ford F150 | Nissan Titan | Toyota Tundra | Dodge Ram 1500 |
|---|---|---|---|---|---|
| Engine | 4.8L V-8 | 4.6L V-8 | 5.6L V-8 | 4.7L V-8 | 4.7L V-8 |
| Trans. | 4-sp. auto | 4-sp. auto | 5-sp. auto | 4-sp. auto | 5-sp. auto |
| City MPG | 17 | 15 | 14 | 14 | 14 |
| Highway MPG | 20 | 19 | 19 | 19 | 18 |

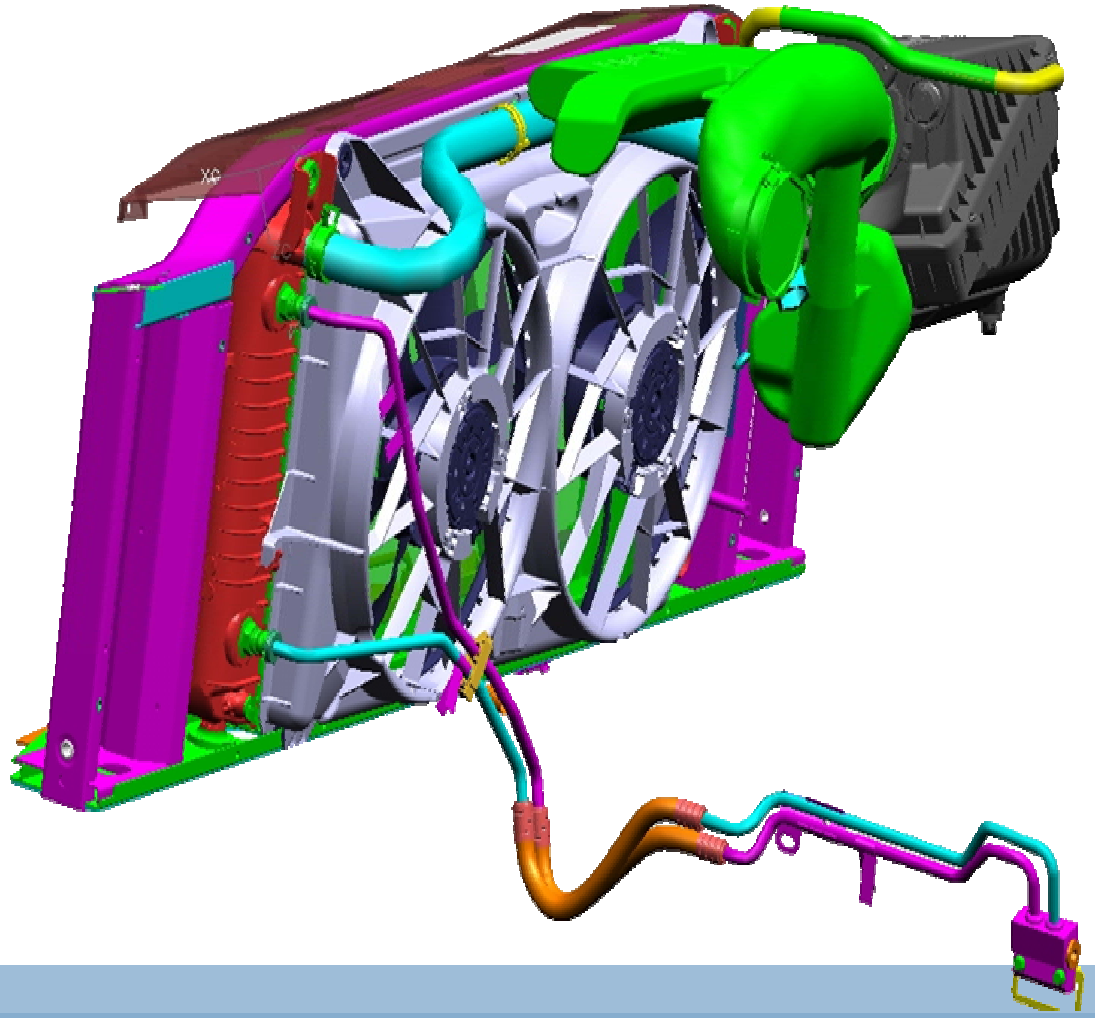
# Case Study: 2005 Full-Size Trucks

- Continuous fuel economy improvement in North America's highest volume platform
  - About 1.7 million total units produced per year
  - About 1.3 million light-duty units produced
- Changes across platform – SUVs and Pickups
- Four components in the 2005 initiative:
  - Electric cooling fans
  - Regulated voltage control
  - Aerodynamics
  - Base axle ratio changes

# 2004 Mechanical Cooling Fan



# 2005 Electric Cooling Fans



# Regulated Voltage Control (RVC)

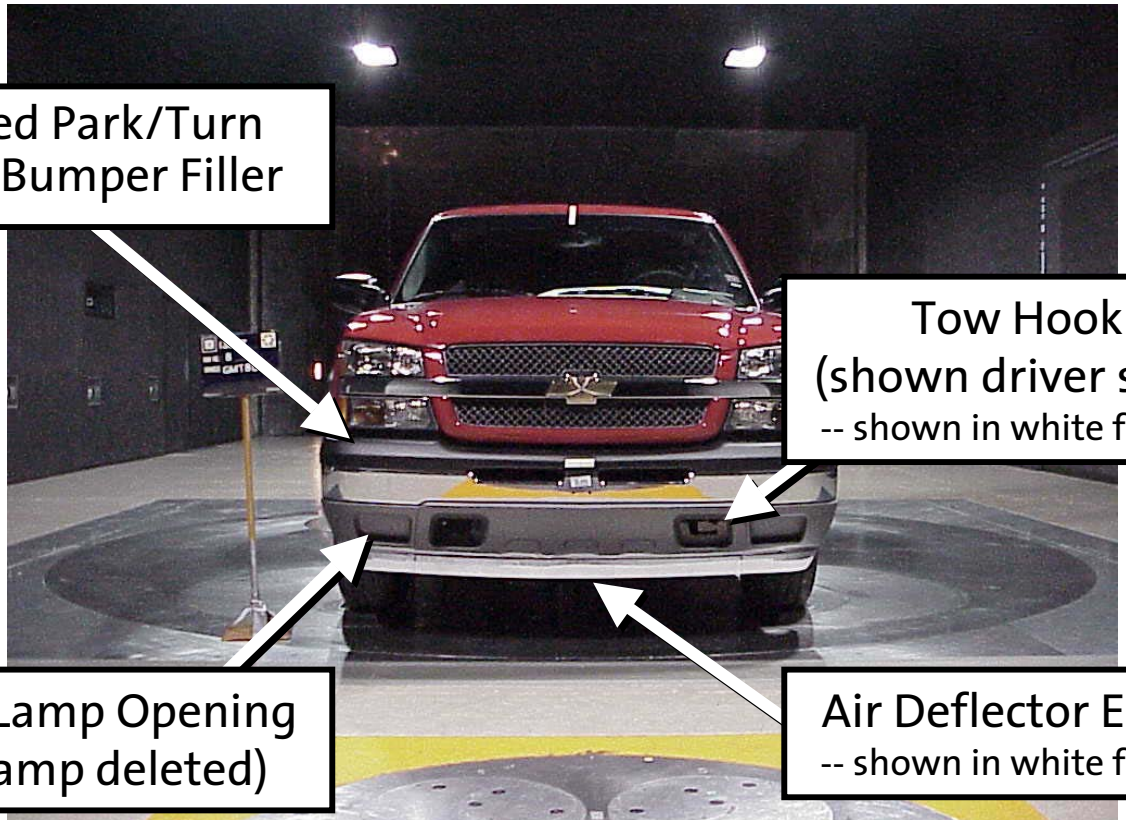
- GM holds one patent on RVC technology, with two additional patents pending
- Monitors state of charge on batteries and controls the  generator to minimize parasitic loss
- Method and system for regulating charge voltage to the battery, improving fuel economy and increasing battery life

# Aerodynamics

- Improved front-end sealing:
  - Tow hook seals
  - Seal openings when tow hooks deleted
  - Seal openings when fog lamps deleted
  - Improved park/turn lamp to bumper filler (Chevrolet Silverado)
  - Seal center hole in front air deflector (GMC SUV)
- Added extension (air dam) to front air deflector
- Improved running board aerodynamics (SUV)
- Redesigned roof-mounted CHMSL (SUV)

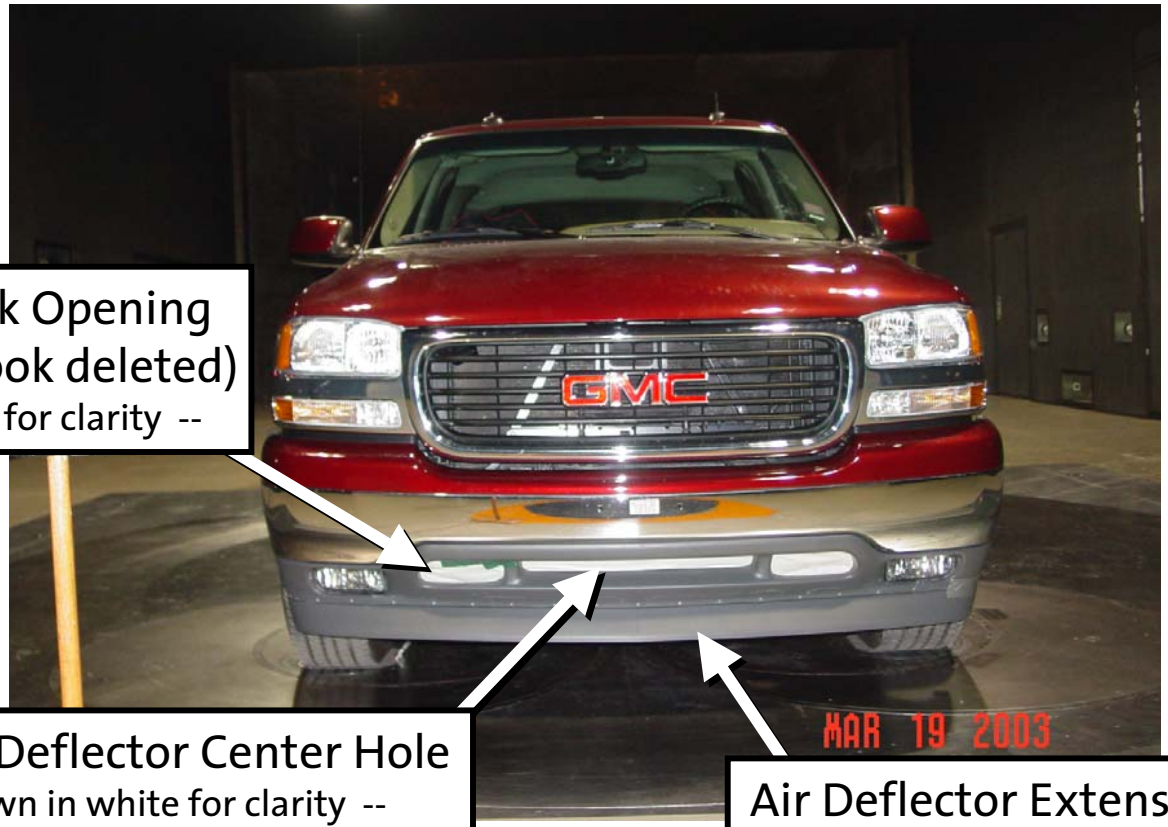
# Aerodynamics

## Chevy Silverado 4WD



# Aerodynamics

## GMC Yukon 2WD




Seal Tow Hook Opening
(when tow hook deleted)
-- shown in white for clarity --

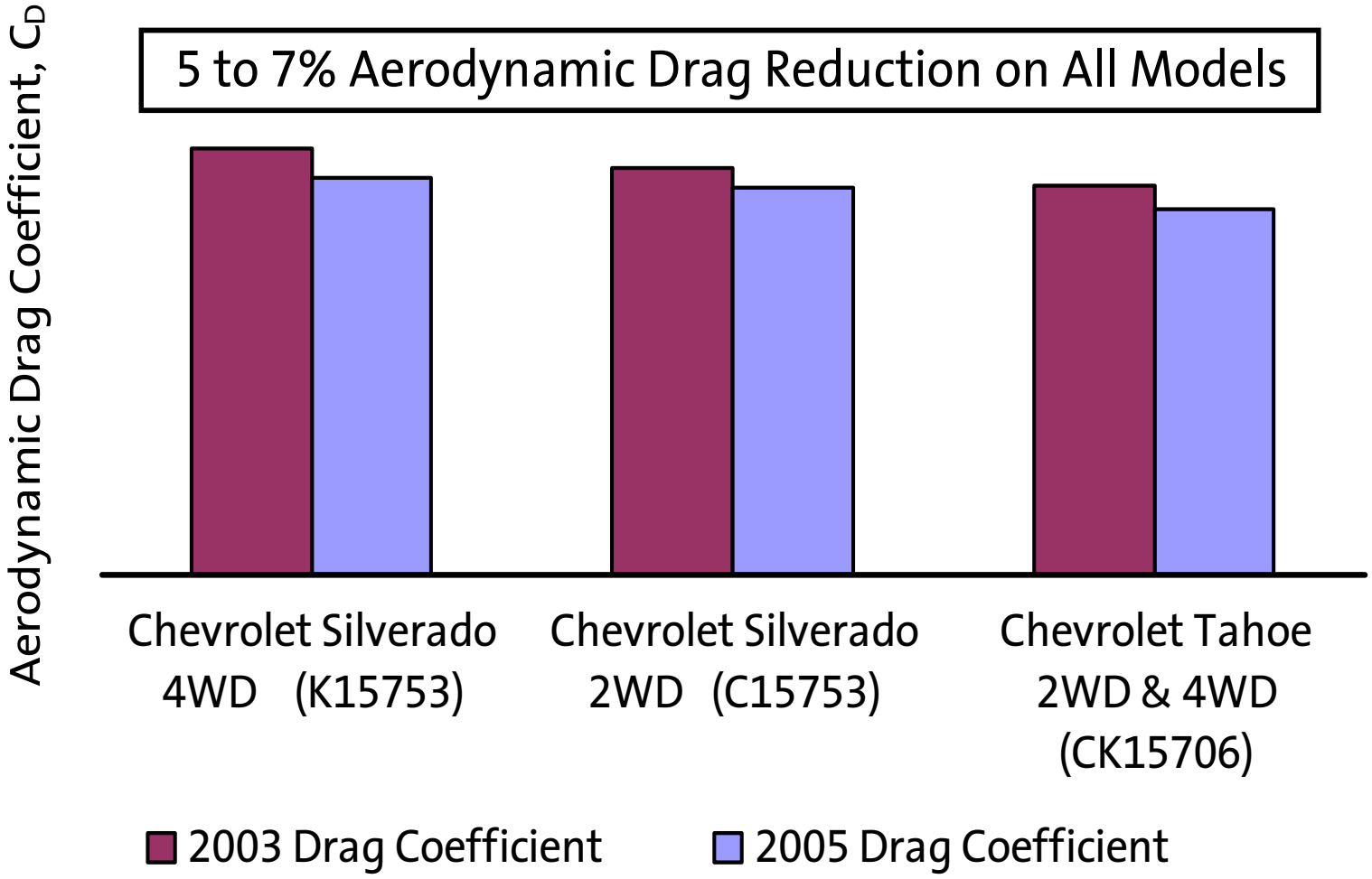
Seal Deflector Center Hole
-- shown in white for clarity --

Air Deflector Extension

# Aerodynamics

## GMC Yukon 2WD

# Aerodynamics



# Base Axle Ratio Changes

| | 9000 | 9500 | 10000 | 10500 | 11000 | 11500 | 12000 | 12500 | 13000 | 13500 | 14000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.3L V-6 | 3.08 | 3.23<br>3.42 | 3.73 | | | | | | | | |
| 2WD<br>4.8L V-8 | | | 3.23 | | 3.42 | | 3.73 | | | | |
| 4WD<br>4.8L V-8 | | | | | 3.42 | | 3.73 | | 4.10 | | |
| 2WD<br>5.3L V-8 | | | | | | | 3.23<br>3.42 | | 3.73 | | |
| 2WD<br>5.3L V-8<br>C15906/36 | | | | | | | | | 3.42<br>3.73 | | 4.10 |
| 4WD<br>5.3L V-8 | | | | | | | | | 3.42<br>3.73 | | 4.10 |

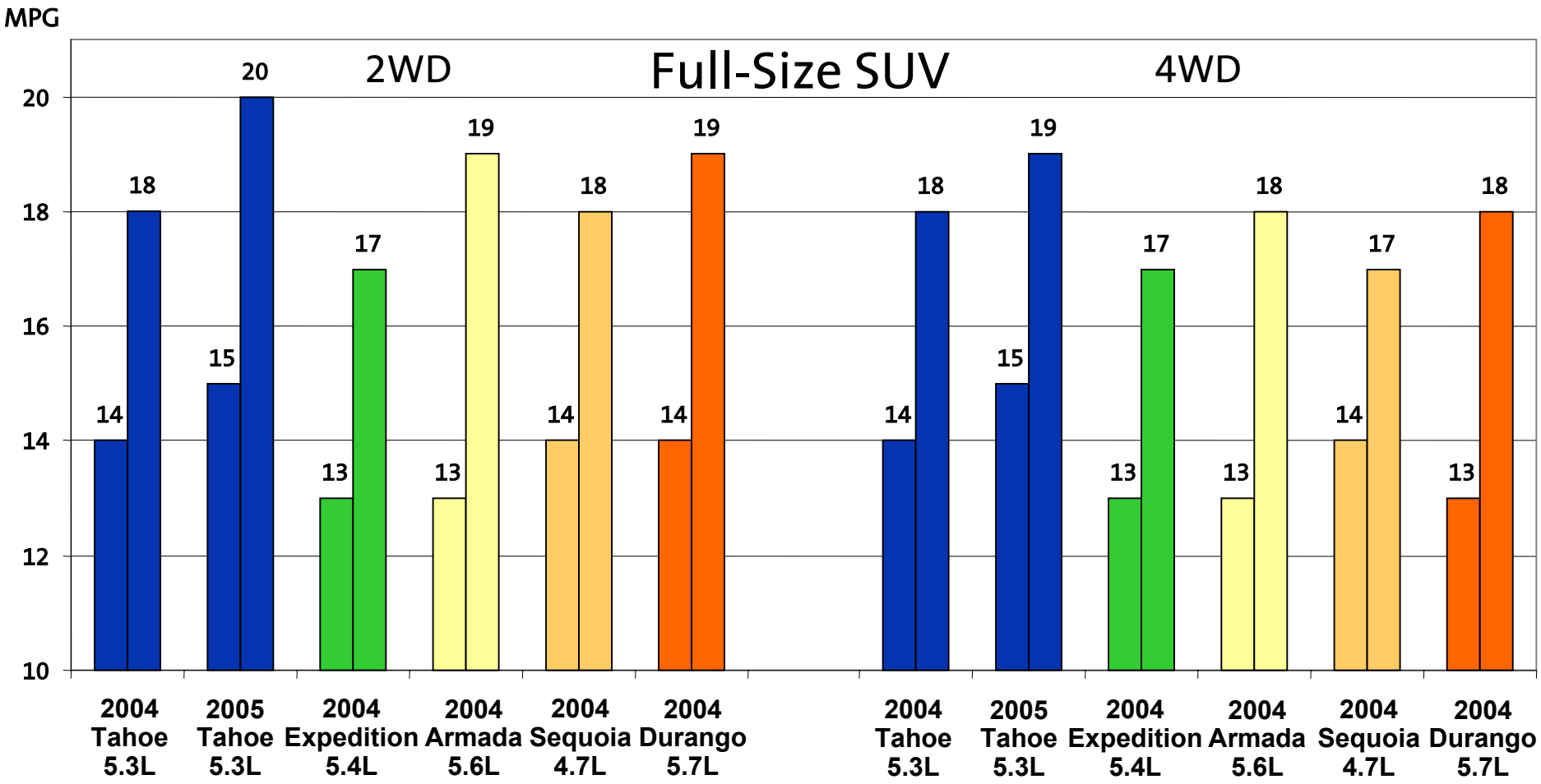
Denotes 2005 base axle  Denotes 2004 base axle  Denotes optional axle

# Typical Fuel Economy Improvement

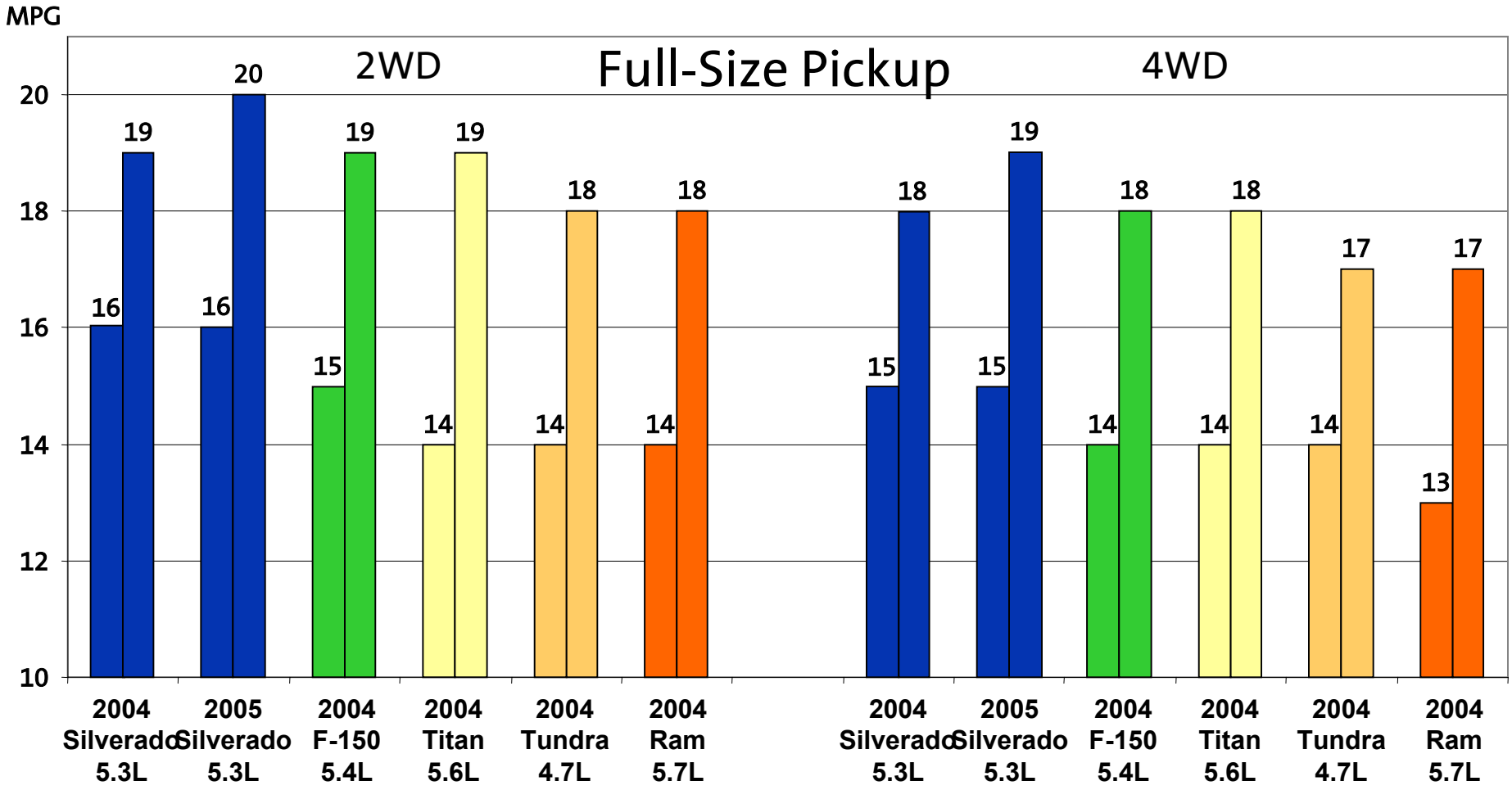
+ 0.20 mpg – electric cooling fans
+ 0.20 mpg – regulated voltage control
+ 0.25 mpg – aerodynamics
+ 0.10 mpg – base axle ratio changes
+ 0.75 mpg – preliminary projections

**+ 1 mpg** typical fuel economy improvement in City and Highway label values across the light-duty, full-size truck portfolio after development, refinement and validation

# SUV City / Highway Fuel Economy Comparison



# Pickup City / Highway Fuel Economy Comparison



# Net Result of 2005 Fuel Economy Average Gain

- 1 mpg typical improvement across the GM light-duty, full-size truck platform
- About 1.3 million units will be produced in 2005
- 15,000 average miles driven per year
- Annual fuel savings of about 28 million gallons
- Equivalent to about 1.4 million barrels of crude oil, or the capacity of a large supertanker

# Summary

- GM vehicles are clear leaders in a number of mainstream vehicle segments, and are competitive in others
- Intelligent application of technology results in customers able to buy vehicles they need with good fuel economy
  - Customer choice is still an important factor
- While working on future technologies, GM continues to improve the fuel economy of today's mainstream vehicles
- The savings are significant
  - 1 mpg typical improvement in full-size truck platform for 2005 has potential to save about 28 million gallons of gasoline per year
  - Equivalent to about 1.4 million barrels of crude oil, or the capacity of a large supertanker